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PHASE I REMOTE SENSING MARINE ARCHEOLOGICAL SURVEY OF THE SOUTHWEST PASS, OCEAN DREDGE MATERIAL DISPOSAL SITE, PLAQUEMINES PARISH, LOUISIANA

FINAL REPORT
APRIL 24, 2001

PREPARED FOR:

U.S. ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

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13. ABSTRACT *(Maximum 200 words)*

This report presents the results of a Phase I Marine Archeological Remote Sensing Survey of the Southwest Pass Ocean Dredged Material Disposal Site (ODMDS) in Plaquemines Parish, Louisiana. This investigation was conducted in September and October 1999, by R. Christopher Goodwin & Associates, Inc. on behalf of the U.S. Army Corps of Engineers, New Orleans District (USACE-NOD). The study was undertaken to assist the USACE-NOD to satisfy its responsibilities under Section 106 of the National Historic Preservation Act of 1966, as amended, prior to continuing the disposal of dredged material at this location. All aspects of the investigations were completed in accordance with the Scope-of-Work, and the Secretary of the Interior's *Standards and Guidelines for Archeology and Historic Preservation* (Federal Register 48, No 190, 1983). The study area for this project consisted of a single survey block comprising the entire ODMDS, which is located at the southern entrance of the Southwest Pass. The survey block measured a total of 6,652.8 ft (2,027.3 m) x 19,377.6 ft (5,906.4 m), or 2,959.5 acres.

The objectives of this study were to identify specific targets that might represent significant submerged cultural resources within the project area, and to provide the USACE-NOD with management recommendations for such resources. These objectives were met with a research design that combined background archival investigations and a marine archeological remote sensing survey.

Background research and archival investigations indicated a low to moderate potential for encountering submerged historic cultural resources within the project area. A review of Louisiana archeological site files and relevant research reports documented no sites within a mile (1.6 km) radius of the project area. A review of Louisiana's shipwreck database, the National Oceanic and Atmospheric Administration's (NOAA) Automated Wreck and Obstruction Information System (AWOIS), various NOAA nautical charts, and several secondary sources identified two wrecking incidents within the survey area. During analysis of survey data, both of these wrecks were located as magnetic target groups.

Archeological investigations consisted of a controlled marine remote sensing survey of approximately 253.0 linear miles (407.4 km) of ocean bottom. This survey utilized a differential global positioning system (DGPS), a digital recording side scan sonar, a recording proton precession magnetometer, digital recording fathometer, and hydrographic navigational computer software. The survey was conducted with a lane spacing of 100 ft (30.48 m) to ensure the greatest detail in coverage. The survey techniques ensured that any abandoned or wrecked historic vessels in the survey area would be detected. The marine remote sensing survey registered a total of 2,335 individual magnetic anomalies. Of these anomalies, 318 disturbances comprise 119 clusters or targets, four of which had five corresponding acoustic anomalies. Of the 119 target groups, 114 were identified as small areas of scattered, and probably modern debris. Three targets (#1, #5, and #8) were associated with channel marker buoys, Target #60 was identified as a pipeline or cable corridor, and Target #115 was identified as an abandoned oil platform that still is visible above the surface; no additional investigations are recommended for these targets.

Two targets (Targets #13 and #37) were associated with the location of shipwrecks identified on NOAA Chart 11361. Target #13 is composed of five magnetic anomalies with no acoustic data observed. This likely is due to the high rate of deposition at the mouth of Southwest Pass, which results in a rapid rate of burial of materials in the channel. Thus, if the magnetic target does represent the mapped wreck, the wreck likely is buried. The addition of further fill is unlikely to adversely affect this potential cultural resource, as the addition of dredge spoils will not exceed the yearly sediment load of the Mississippi River at this location. No further work is recommended for Target #13 in connection with this undertaking.

Target #37 also may be associated with a known shipwreck, mapped on NOAA Chart 11361. As with Target #13, the absence of acoustic data likely results from burial of the resource. The addition of further fill is unlikely to adversely affect this potential resource. The present sediment loading from the Mississippi River has sufficiently buried these resources and encapsulated them to the extent that further burial will not affect the structures. No further work is recommended for this target or for any target determined from this survey due to the fact that they are not indicative of significant cultural resources.

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Special thanks are also due to the staffs of the following repositories: The Louisiana Department of Culture, Recreation and Tourism, Office of Cultural Development, Divisions of Archaeology and Historic Preservation, the Howard-Tilton Memorial Library at Tulane University, and the Library of Allen Green, Hammond, Louisiana. Particular thanks are extended to Mr. Steven Very of NOAA for providing a prompt response to our request for information from the Automated Wreck and Obstruction Information System.

R. Christopher Goodwin, Ph.D., served as Principal Investigator for this project. Jean B. Pelletier, M.A., served as Project Manager, directed all aspects of data collection and its subsequent analysis, and was assisted by Nautical Archeologist, Larkin A. Post, B.A., and Nautical Archeologist David Trubey B.A. Remote Sensing Specialists Sarah A, Milstead, B.A., and Douglas Jones B.A. also helped with report preparation. Richard Vidutis Ph.D. served as project historian, and April L. Fehr, M.A., prepared the editorial review for the report. Graphics were prepared by Barry Warthen, B.A., David Olney, B.A. and Jean B. Pelletier, M.A. The report was produced by Ms. Stacy Beitz and Ms. Sharon Little.

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FINAL REPORT

R. CHRISTOPHER GOODWIN, PH.D.
PRINCIPAL INVESTIGATOR

BY

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FOR

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER I

INTRODUCTION

This report presents the results of the Phase I Marine Archeological Remote Sensing Survey of the Southwest Pass, Ocean Dredged Material Disposal Site in Plaquemines Parish, Louisiana (Figure 1). The investigation was conducted from September 20 – October 5, 1999, by R. Christopher Goodwin & Associates, Inc. on behalf of the U.S. Army Corps of Engineers, New Orleans District (USACE-NOD) in support of the continued disposal of dredge material at this location. In keeping with the New Orleans District's mission to preserve, document, and protect significant cultural resources, a magnetic and acoustic remote sensing survey was undertaken to locate potential archeological remains and in so doing, to assist the USACE-NOD in satisfying its responsibilities under Section 106 of the National Historic Preservation Act of 1966, as amended. All aspects of the investigations were completed in full compliance with the Scope-of-Work; with 36 CFR 800, "Protection of Historic Properties;" with the Abandoned Shipwreck Act of 1987 (43 U.S. C. 2101 – 2106); with Abandoned Shipwreck Guidelines, National Park Service; with National Register Bulletins 14, 16, and 20; with 36CFR 66; and with the Secretary of the Interior's *Standards and Guidelines for Archeology and Historic Preservation* (Federal Register 48, No 190, 1983).

The survey area for this project (Figure 2) consisted of one continuous survey block measuring approximately 6,652.8 ft (2,027.8 m) wide by 19,377.6 ft (5,906.4 m) long. In total, approximately 253 linear miles (407.4 km) of ocean bottom were surveyed. The survey area (and the ODMDS zone) are delineated by the following coordinates:

NW Corner – 28°54'20"N x 89°27'25"W
NE Corner – 28°54'20"N x 89°26'00" W
SW Corner – 28°51'00" N x 89°27'25" W
SE Corner – 28°51'00" N x 89°26'00"W

Research Objectives and Design

The objectives of this study were to identify all submerged and visible watercraft and other maritime related cultural resources in the Southwest Pass, ODMDS project area; whenever possible, to assess the National Register of Historic Places (NRHP) eligibility of identified resources, applying the Criteria for Evaluation (36 CFR 60.4 [a-d]); and to provide the USACE-NOD with management recommendations for such resources. These objectives were addressed through a combination of archival research and field survey. The background study and history of the project area were researched through examination of archeological site files for the State of Louisiana, local historical literature files, previous cultural resources investigations conducted in the vicinity of the project area, historic maps, relevant primary map and microfilm records, and secondary literature.

Field survey of the project area was conducted from the 24-ft research vessel *Coli,* leased from the Louisiana Universities Marine Consortium (LUMCON). The project area was divided into 68 parallel track lines or transects spaced at 100-ft intervals. The equipment array used for the Southwest Pass, ODMDS survey included a DGPS, a proton

precession marine magnetometer, side scan sonar, and a fathometer. Data were collected and correlated by a laptop computer using hydrographic survey software. Data were inventoried, post-processed, and analyzed to identify specific targets within the project area that might represent significant submerged cultural resources.

R. Christopher Goodwin, Ph.D., served as Principal Investigator for this project. Mr. Jean B. Pelletier, M.A., who served as Project Manager, directed all aspects of data collection and its subsequent analysis, with the assistance of Nautical Archeologists, David W. Trubey, B.A. and Larkin A. Post, B.A. Remote Sensing Specialists Sarah A. Milstead, B.A., and Douglas Jones, Ph.D. also helped with report preparation, and Captain Samuel LeBoeuf operated the survey vessel.

Organization of the Report

This report develops the natural and historical contexts of the project area as the basis for analysis and interpretation. The geological and prehistoric settings of the project area are discussed in Chapter II. Chapter III places the project area within its historic context, and develops a historic-chronological framework for evaluation of classes of submerged historic resources, particularly shipwrecks. Chapter IV reviews research methods and sources used during archival and archeological investigation; Chapter V presents previous investigations in the vicinity of the project area, and chapter VI presents the results of archival research. Results of the field survey and analysis of this data are described in Chapter VII. A summary of the study and management recommendations is provided in Chapter VIII.

Appendix I contains the original Scope-of-Work for this project. Appendix II contains the curriculum vitae for key project personnel. Appendix III contains the tables for this project.

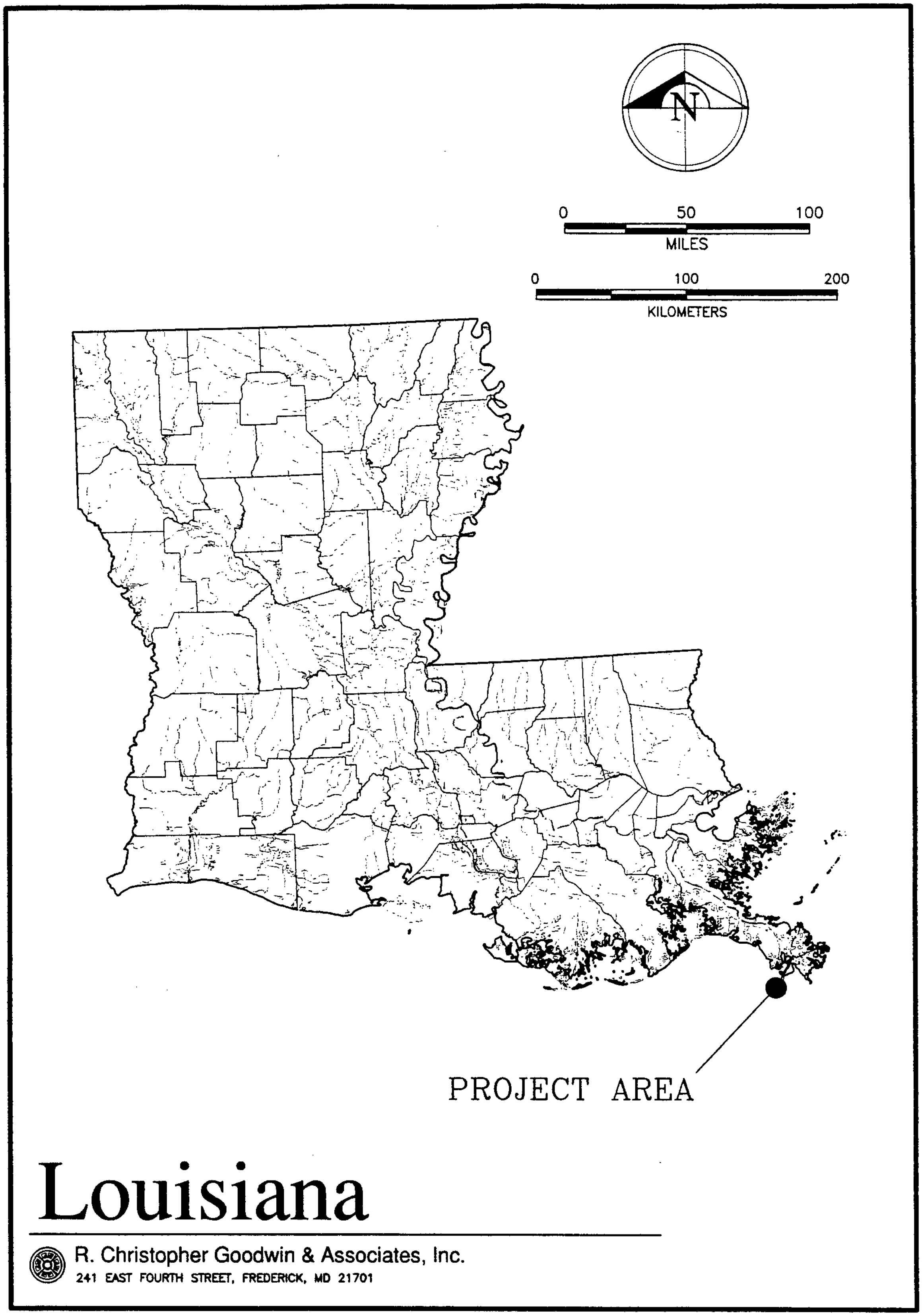
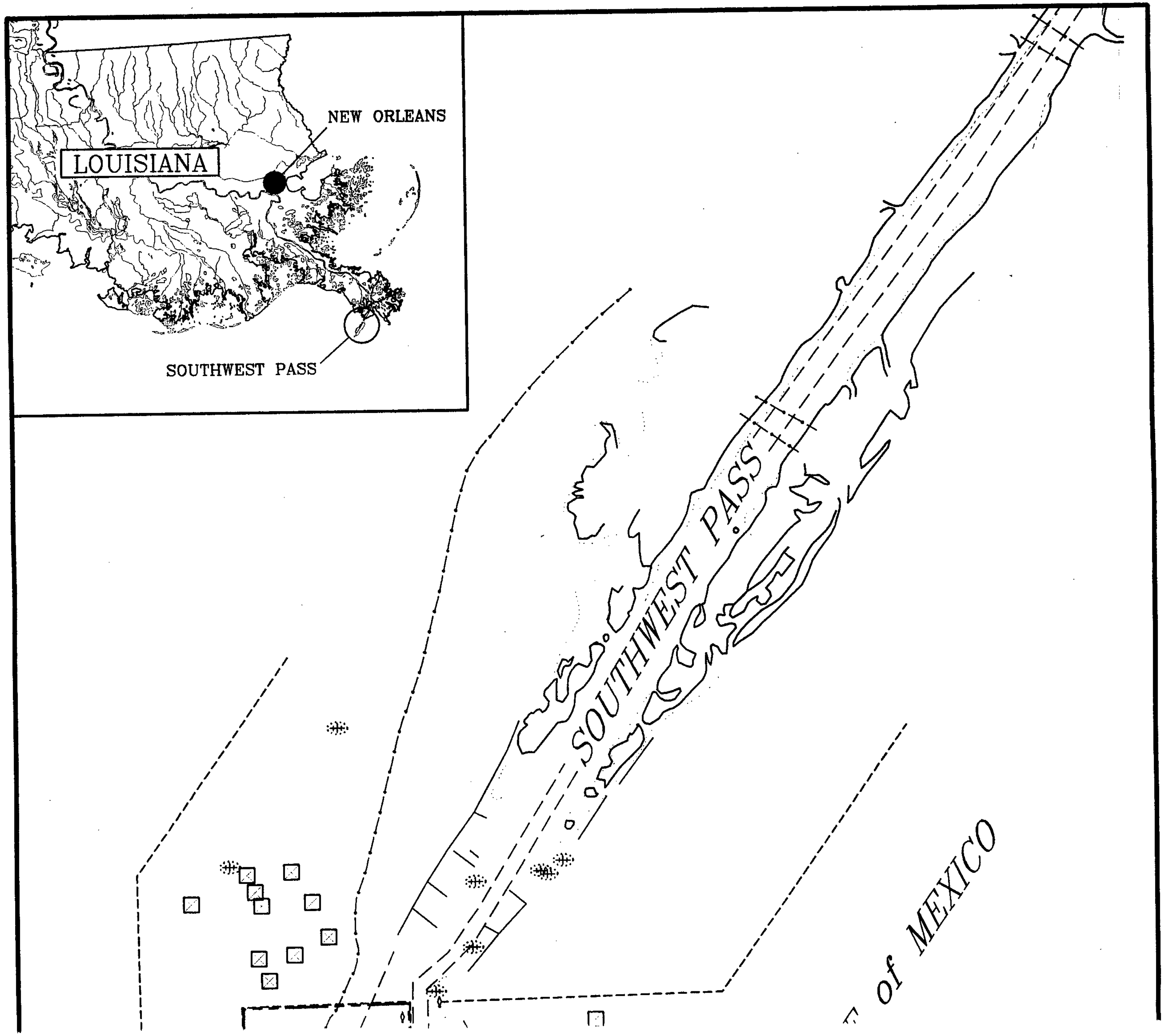


Figure 1. Southwest Pass ODMDS Project Area, Mississippi River, Plaquemines Parish, Louisiana.



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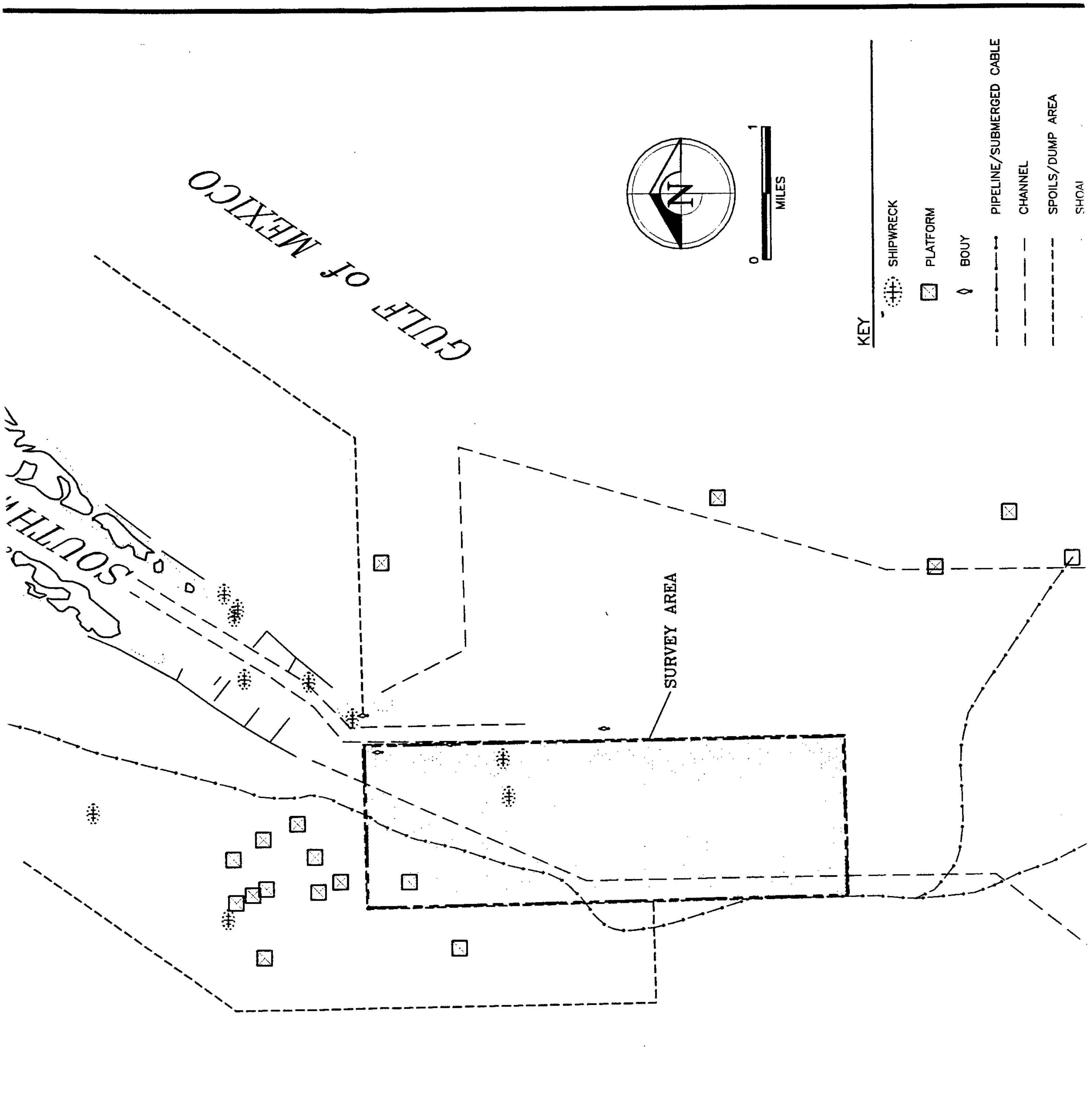
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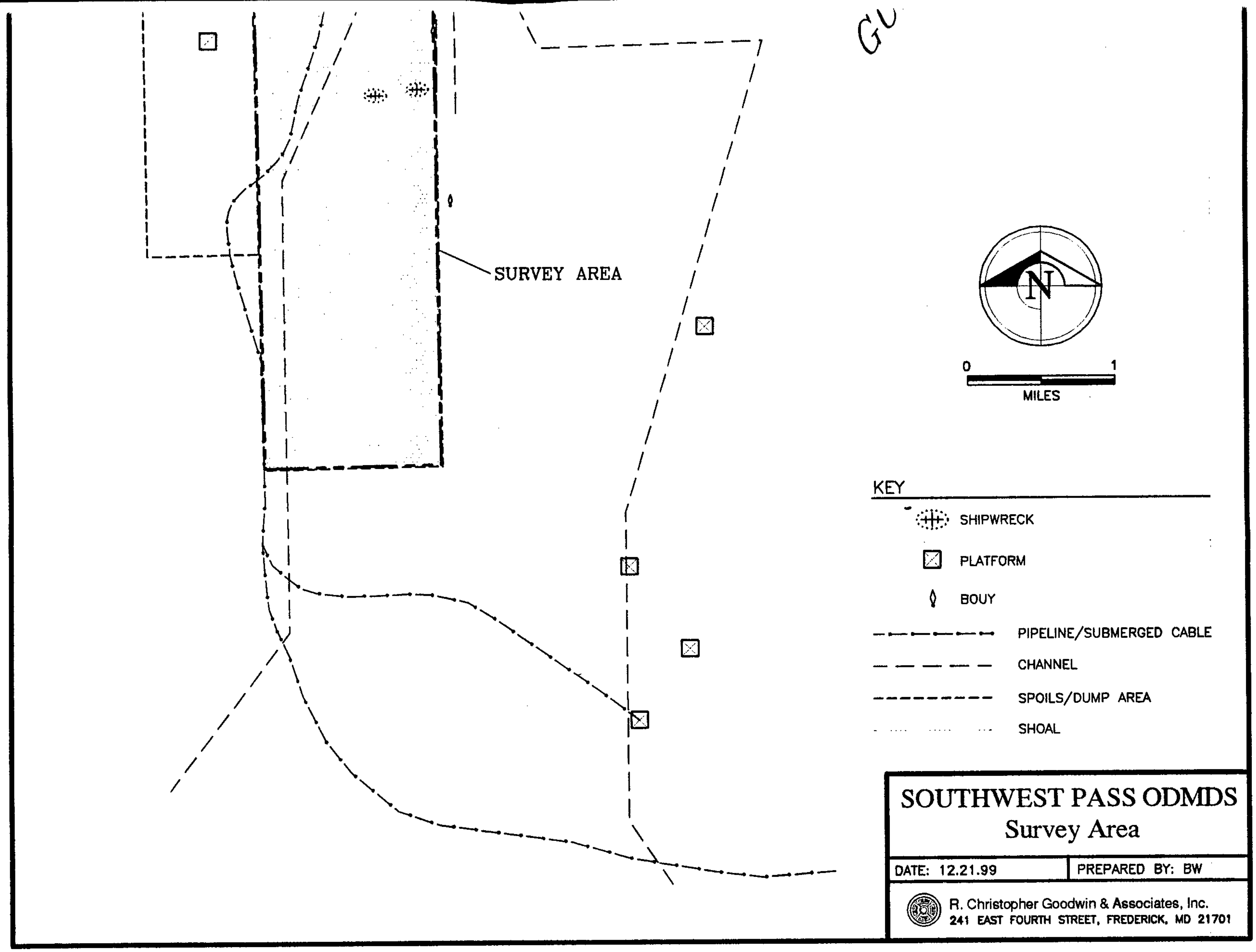

Figure 2. Location map of Southwest ODMDS Pass showing Survey Area.

3

CHAPTER II

NATURAL SETTING OF THE SOUTHWEST PASS ODMDS AREA

The focus of this section of the report is the geologic setting and geomorphic processes of the modern, active (Balize) delta of the Mississippi River as they relate to the development of Southwest Pass, one of the principal distributaries of the river and the ODMDS. It provides insights into aspects of the river's physiography, sedimentation, and stratigraphy that should be helpful in understanding the natural history context of potential cultural resources. No geomorphological field investigations were conducted as part of this effort and no new data were produced. However, the chapter summarizes the most current theories about the geomorphology and geoarcheology of the region.

Geographic and Physiographic Settings

The active Mississippi River delta, where the stream discharges into the Gulf of Mexico, lies at the extreme southeastern tip of the Mississippi River delta plain of southeastern Louisiana. It is defined by the extent of those delta distributaries that have been active in historic times. These lie southeast of the town of Venice in Plaquemines Parish, and include six channels (passes) (Figure 3). The three farthest upstream passes--Baptiste Collette, Grand-Tiger, and Main--are minor and are largely inactive as far as delta growth is concerned. The larger and active ones are farthest downstream; they include the Southwest and South Passes and the Pass a Loutre, with several of its branches. These three major passes bifurcate at a point known as Head of Passes (HOP) just downstream from the community of Pilottown, LA. The pattern of bifurcation is the origin of the term "birdfoot delta" that often is used to describe the modern delta and to differentiate it from other types of delta plains (Fisk 1961). Navigation into and out of the mouth of the Mississippi River has been impeded seriously by bars at the mouths of the major passes. This problem has required constant attention, study, and expensive engineering works and activities for many decades.

Up to and including most of the nineteenth century, the Grand-Tiger and Main Pass complexes were the favored navigation channels, but in the twentieth century, Southwest Pass has assumed that role as a result of jetty construction and frequent dredging. Prior to jetty construction between 1902 and 1908 (Russell 1936), Southwest Pass was about 28.9 km (18 mi) long (below HOP). At the present time, it measures about 32.5 km (20.2 mi) long. The jetties consist of inner bulkheads and outer stone jetties on both sides of the pass that generally extend from below Mile 15 (below HOP) to its mouth (Mississippi River Commission 1976). In addition, short lateral spur dikes are located at several-hundred-meter intervals within the pass for most of the distance below the HOP. These navigation improvements help to maintain a 12.2 x 243.8-m (40 x 800-ft) shipping channel between miles 0 and 18, and a 12.2 x 182.9-m (40 x 600-ft) channel from mile 18 to the entrance channel outside the jetties. The overall width of the pass between its banks actually averages between 341 and 402 m (1,120 and 1,320 ft) and there are some reaches where the natural depth approximates 18.3 m (60 ft). In contrast to shallow-water

lobe distributaries, the channel has shown no tendency toward meandering or lateral migration. Point bar deposits, indicative of lateral accretion, are completely absent along the pass.

Although the literature generally states that the three major passes handle about 80 per cent of the total river discharge, division of the river's flow between passes has been variously estimated. Welder (1959) stated that Southwest Pass carries 29 per cent of the total discharge, but Benson and Boland (1986) held that it carries 31.5 per cent of the discharge. These differences are not considered significant or indicative of a trend; rather, they probably reflect differences in measurement techniques. To place these values in context, Coleman and Roberts (1991) measured the average discharge of the river at 12,063 cu m/sec (142,000 cu ft/sec) and its maximum discharge has been recorded at 56,637 cu m/sec (2,000,000 cu ft/sec). Coleman and Roberts (1991) also estimated the average annual sediment load of the river at approximately 31,752,000 kg (700,000,000 tons).

Physiographically, the Southwest Pass, the end of which meets the ODMDS, is a narrow neck of land generally less than 4.8 km (3.0 mi) wide that projects seaward from the main delta plain landmass (Figure 4). In its natural state, the pass originally was bordered by very narrow natural levee ridges only a few hundred meters wide and less than 1 m (3.0 ft) above sea level. The natural levees decreased slightly in width and height in a downstream direction and were bordered by areas of fresh to intermediate intratidal marsh. According to O'Neil (1949), the marshes were vegetated with alligator grass (*Alternanthera philoxeroides*) and water hyacinth (*Eichornia crassipes*) with lesser amounts of cattail (*Typha spp.*), roseau cane (*Phragmites communis*), fresh marsh three-cornered grass (*Scirpus americanus*), dog-tooth grass (*Panicum repens*), yellow cutgrass (*Zizaniopsis miliacea*), oyster grass (*Spartina alterniflora*), and duck potato (*Sagittaria latifolia*). Most of the natural levee ridges also supported marsh grasses, with stands of willow (*Salix nigra*), hackberry (*Celtis laevigata*), and cottonwood (*Populus deltoides*) only on the higher elevations. More recently, Chabreck and Linscombe (1978) characterized the marsh vegetation as including wiregrass (*Spartina patens*), deer pea (*Vigna repens*), bulltongue (*Sagittaria sp.*), wild millet (*Echinochioa walteri*), bullwhip (*Scirpus californicus*), and sawgrass (*Cladium jamaicense*). The more recent assemblage reflects an overall trend toward higher salinity, which may be indicative of the deterioration of the wetlands due to subsidence.

Most of the marshes along Southwest Pass area are associated with two small crevasses that formed small lobes or splays. The larger of the two formed on the left descending bank near river mile 5 below HOP and is marked by Joseph Bayou (Russell 1936). The smaller of the two formed on the right descending bank near river mile 9 below HOP and is marked by Double Bayou. Joseph Bayou was described as 3.4 m (11 ft) deep, 30.5 m (100 ft) wide, and about 3.2 km (2 mi) long in 1897. It was closed by a dam (stone jetty) in 1906 and by 1936, it was only 3.0 m (10 ft) deep and 15.2 m (50 ft) wide.

At the present time, a large proportion of the "land" along Southwest Pass consists of areas where dredge spoil has been placed during hydraulic maintenance dredging operations. The pass area landscape is dominated by artificial structures such as a Coast Guard Station, a pilots' station, numerous navigation lights, and production platforms, tank farms, and piers and docks related to petroleum production. While the normal tidal range along Southwest Pass is only 39.6 cm (1.3 ft), the entire area is submerged during storm tides that accompany tropical storms and hurricanes. All structures must be able to withstand occasional inundation to a depth of several meters since there are no flood-control levees or floodwalls in this part of the delta. During severe hurricanes, wave heights of over 20 m (65 ft) have been recorded on offshore platforms in deep water off around the delta's perimeter, but these heights decreased to 3 to 5 m (10 to 15 ft) in water depths of 18 m (60 ft) or less (Bea and Audibert 1980). Storm surges of

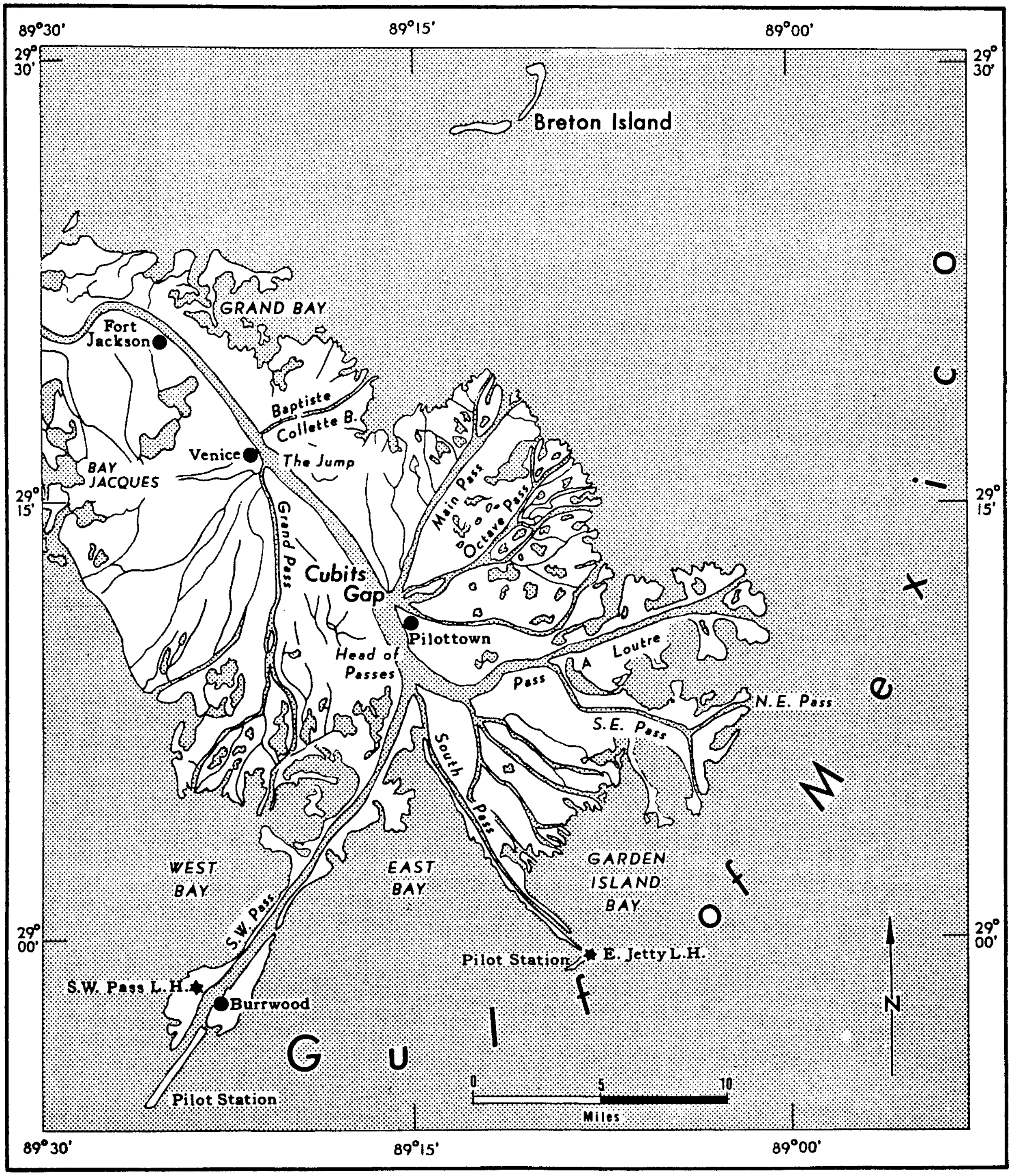

Figure 3. Lower (modern) delta of the Mississippi River. From Welder (1959)

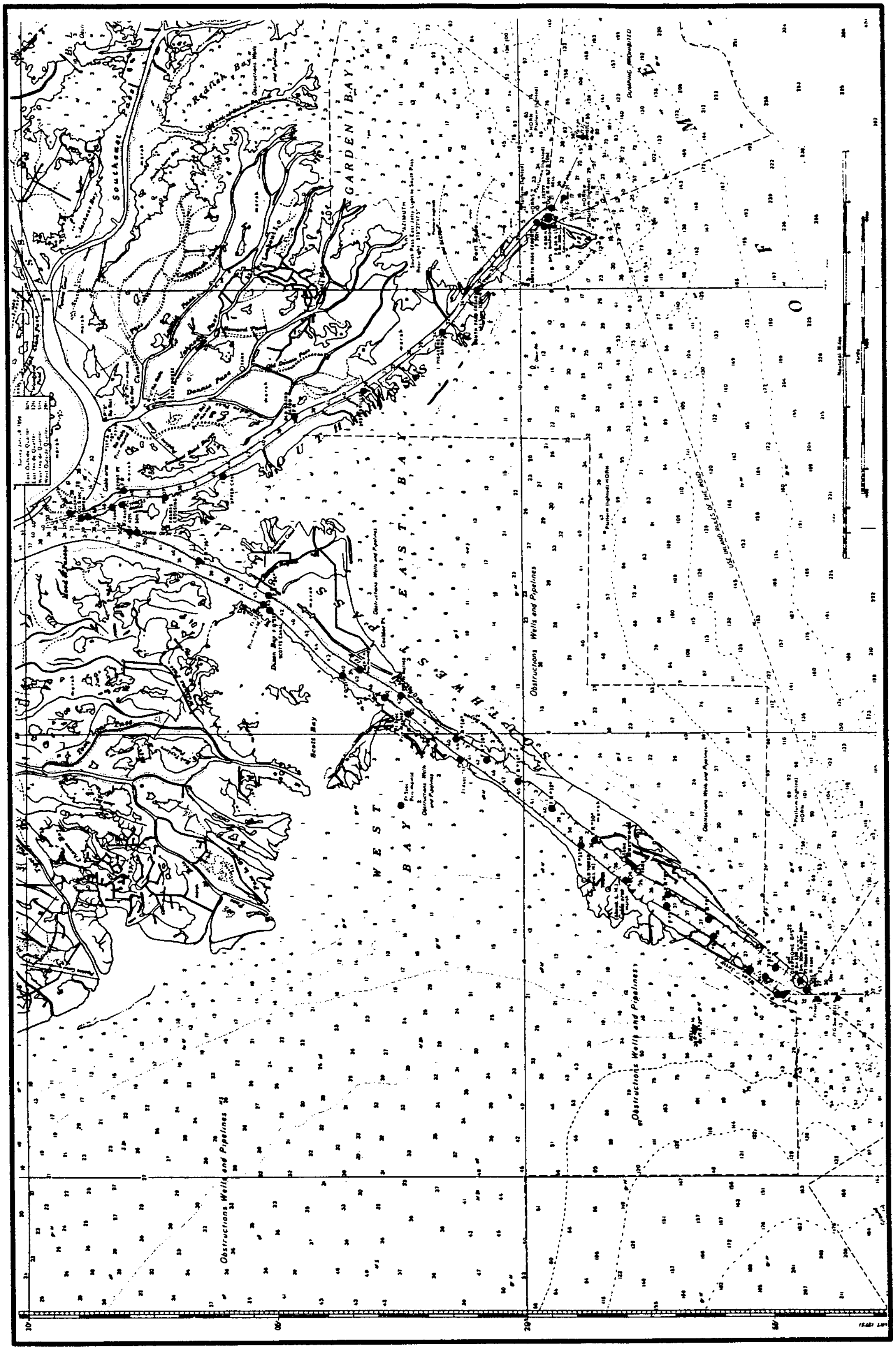

Figure 4. Extent of Southwest Pass as surveyed in 1959

this magnitude could affect the immediate Southwest Pass area.

During times of high water due to upstream flooding on the river, the stage at HOP has reached an elevation of 1.58 m (5.2 ft) (NGVD) before the water surface slopes to Gulf level at the mouth of the pass. At such times, the entire delta is flooded much as it is during storm surges. At low water, all of Southwest Pass is affected by tides and a salt wedge crosses the bar and moves upstream to a distance of 241 km (150 mi) or more.

In relation to subsequent discussions of the bar at the mouth of the pass, it is important to note that the end of the pass is essentially at the edge of the continental shelf. In fact, sediments discharged through the pass have created an extensive platform that has extended the shelf edge across the 240 ft (73-m) contour. Water depths of 250 ft (76 m) in the Gulf presently occur as close as 11.4 km (7.0 mi) to the tip of the jetties and the 100 fathom (183 m) contour lies only 34.8 km (21.6 mi) offshore.

General Geologic Setting

Southwest Pass and the modern (Balize) delta are situated in the Gulf segment of the Coastal Plain Province of North America. The overall Mississippi delta plain is a broad, low-lying tract of alluvial land that is entirely of Holocene age and nowhere more than a few thousand years old. Geologically, it overlies the northern portion of the east-west trending Gulf Basin, a deep structural trough where the continental crust of Paleozoic basement rocks has been depressed and where mostly unconsolidated sediments of fluvial, estuarine, and marine origin have accumulated to a thickness of tens of thousands of meters. The northern flank of the Gulf Basin is characterized by prevailing subsidence, east-west trending zones of active faults, and the diapiric intrusion of salt to form piercement-type salt domes (Murray 1961).

More specifically, the Mississippi River delta plain is the surface manifestation of a relatively thin, seaward thickening prism of Holocene delta and shallow marine deposits that overlies Pleistocene deposits of similar origin and still older ones with depth (Kolb and VanLopik 1958). The Southwest Pass area lies where the prism begins to thicken sharply near the edge of the continental shelf. Fisk and McFarlan (1955) indicate that the top of Pleistocene-age deposits occurs at a depth of about 198 m (650 ft) near HOP but may be deeper (about 305 m [1,000 ft]) at the tip of the pass.

The prism of Holocene delta deposits represents a series of distinctive onlapping sedimentary cycles initiated by upstream diversions of river flow, each cycle being the correlate of a discrete delta complex. Each cycle involves sediments laid down in multiple environments ranging from fresh to saline water in a dynamic zone of interaction where the river emptied into the Gulf. The cumulative result of these multiple cycles has been a net buildup and seaward buildout of the delta plain. The Balize complex or birdfoot delta (also referred to as the Plaquemines-Modern complex) is the most recent of these complexes (Frazier 1967), and is the only one to have formed in relatively deep water: all the others are truly shallow-water complexes with distributaries that form a "horsetail" pattern.

Each delta complex in turn involves a series of delta lobes, a lobe being defined as that portion of a complex that formed during a relatively short period of time (decades to centuries) and that can be attributed to a single or discrete set of delta distributaries. Each lobe involves a characteristic pattern of sedimentary facies representing discrete environments of deposition such as natural levee, intratidal wetland, and bay-sound. In terms of its depositional environments and sedimentary architecture and because of its youthful state of development and brief history, the Balize complex (birdfoot delta) basically can be considered as a single lobe. Forming the flesh on the skeletal framework of major distributaries (passes) of the lobe is a series of lenticular sedimentary masses (Figure 5) (Coleman and Gagliano 1964). These masses, analogous in surficial landforms and environments to mini lobes of short duration, are crevasse systems dating from the historic period. The crevasse

systems formed in shallow bays (bay fills) between or adjacent to major distributaries and extended seaward through a system of radial, bifurcating channels similar in planform to the veins of a leaf. Along Southwest Pass, the Joseph and Double Bayou systems are historic period crevasses.

Because of the prevailing influence of subsidence and sea level rise during the late Holocene (including the historic period), each delta lobe and crevasse system has experienced a constructional or progradational phase in which fluvial processes dominated, and a subsequent destructional or transgressive phase in which marine processes become progressively more dominant (Figure 6). Crevasse systems form initially as breaks in major distributary natural levees during flood stages, gradually increase in flow through successive floods, reach a peak of maximum discharge and deposition, wane, and become inactive. Eventually the dead systems are inundated and revert to bay environments, thus completing the sedimentary cycle.

Basic Geologic Controls

Two processes--subsidence and sea level rise--are the paramount controls to be considered in virtually all aspects of the geomorphology and geoarcheology of the Mississippi River delta plain. For more than a century, it has been known that delta plain landforms, and the structures and facilities located on them, are sinking at a rapid rate not only in geological time frames but human time frames as well. Geologically, subsidence can be defined simply as the relative lowering of the land surface with respect to sea level. Subsidence may involve five basic factors or natural processes (Kolb and VanLopik 1958): (a) true or actual sea level rise; (b) sinking of the basement (Paleozoic) rocks due to crustal processes; (c) tectonic activity such as faulting; (d) consolidation of the thousands of meters of sediments in the Gulf Basin; and (e) local consolidation of near surface deposits due to desiccation and compaction. All of these factors are present in the Balize complex area.

The rate of the true sea level rise component of subsidence has declined during the Holocene period as the effects of the waning of the last continental glaciation have declined (Saucier 1994). Sea level reached its last glacial maximum lowstand about 18,000 years ago and began rising rather rapidly thereafter. About 10,000 years ago, for example, the rate of sea level rise might have been as high as 20 mm/yr (0.79 in/yr), but between 5,000 and 3,500 years ago, it is believed to have declined to 6 mm/yr (0.24 in/yr). Within the last several centuries, it has probably averaged less than 1 mm/yr (0.04 in/yr). However, when other components are included, the total subsidence rate for the delta plain over the last several thousand years has been estimated from geological evidence at about 2.38 mm/yr (0.09 in/yr) (Kolb and VanLopik 1958).

There can be no doubt that the highest rates of subsidence currently occur in the Balize complex. Although the rate of sea level rise during historic times has been relatively low in a geological context, basement sinking, faulting, and especially local consolidation of sediments have been quite active. Based on tidal records and observations of structures (Kolb and VanLopik 1958), estimates of late historic-period subsidence at locations such as HOP, Burrwood, Balize, and Port Eads vary from about 5.0 to 48.0 mm/yr (0.19 to 1.9 in/yr) with the mean value being 23.0 mm/yr (0.9 in/yr). Considered in a different perspective, it has been estimated that the shallowest Pleistocene formation underlying the complex, deposited at least 30,000 years ago, has been downwarped by about 152 m (500 ft) by the combined processes of subsidence.

The effects of subsidence are manifested strongly in the Balize complex in ways other than the sinking (and sometimes burial) of artificial structures. In the cases of the now largely inactive Joseph and Double Bayou crevasse systems, there has been a dramatic loss of vegetated wetlands and a corresponding increase in the extent of shallow open water in the last several decades (May and Britsch 1987). In addition, perhaps two-thirds of the wetlands along Southwest

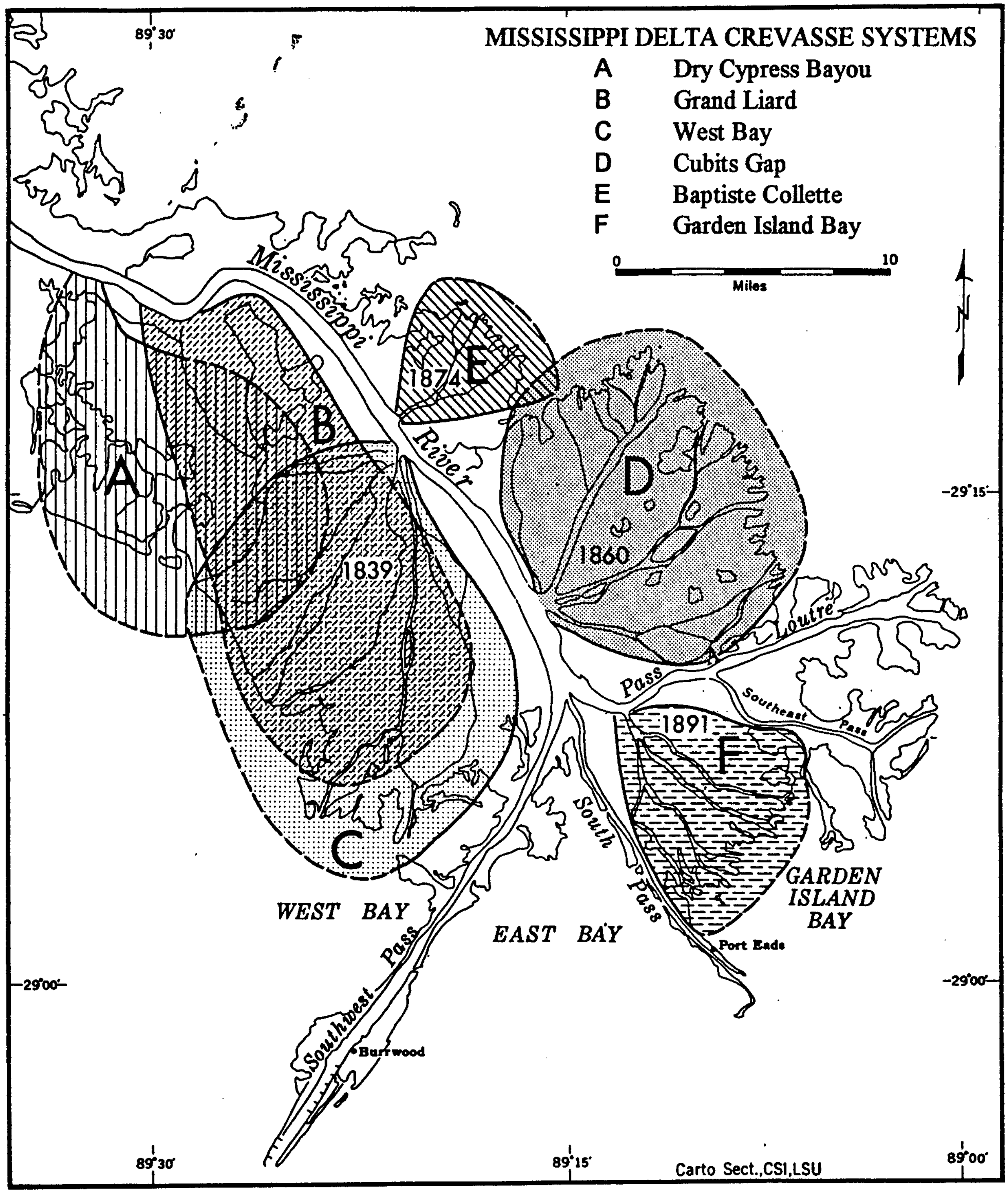

Figure 5. Crevasse systems of the modern (birdfoot or Balize) delta. Modified from Coleman and Gagliano (1964)

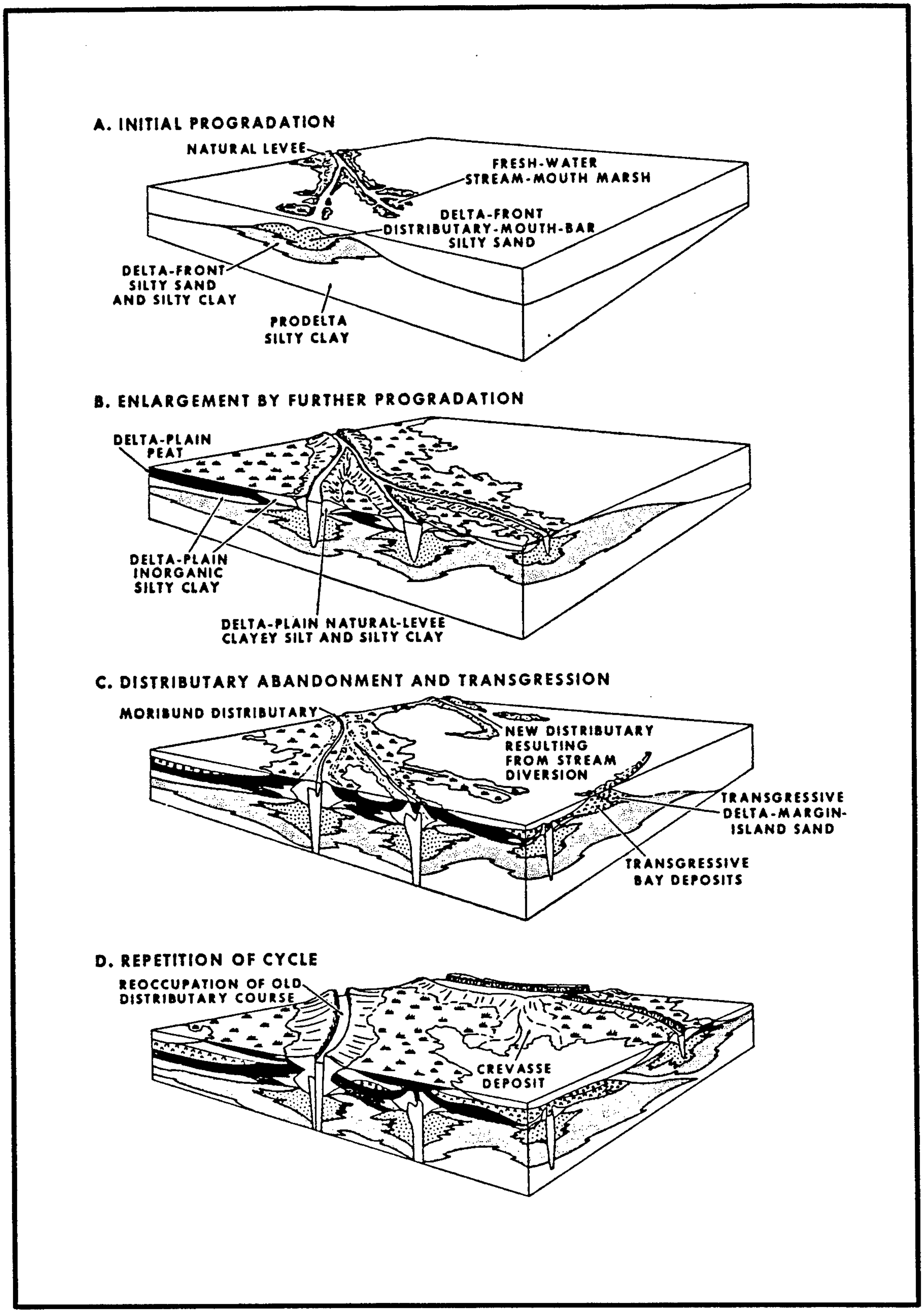

Figure 6. Idealized surface and subsurface distribution of environments of deposition at several stages in a typical delta cycle. From Frazier and Osanik (1965)

Pass below River Mile (RM) 12 below HOP were destroyed by erosion between 1932 and 1983. On the other hand, perhaps aided by the deposition of dredged material, the wetlands, which occur in narrow bands along the pass between RM 0 and RM 12 below HOP, have nearly doubled. While much of the wetland loss probably is attributable to canal dredging by the petroleum industry, overall wetland loss probably is due to salt water intrusion and plant community changes as well as the decline in Mississippi River discharge and sediment load caused by the growth of the Atchafalaya River distributary in south-central Louisiana.

Geomorphic Processes and Depositional Environments

Discussion of the sedimentary facies and depositional environments of the Southwest Pass area is complicated by the fact that the region contains elements typical of both shallow-water deltas and those unique to the Balize deep-water delta. Initially, seven environments--four subaerial and three subaqueous—will be described; these are listed under the heading *Balize Delta* since they pertain both to the complex (single lobe) as a whole as well as to individual crevasses. Subsequent discussions will deal with three geomorphic elements--not environments *per se*--that are unique to the major passes of the Balize delta.

The typical distribution of depositional environments in a delta lobe or crevasse is shown in plan in Figure 7. The actual occurrence in the subsurface in a sedimentary sequence of several environments as shown in a boring near Fort Jackson (about river mile 20 above HOP) is shown in Figure 8.

Balize Delta

Subaerial Environments. The *natural levee* environment includes those small, linear ridges that flank both sides of a channel (e.g., a distributary) that carries a heavy suspended sediment load and that periodically overtops its banks. The ridges are composed of firm to stiff, oxidized silts and silty clays. They are highest, thickest, and coarsest adjacent to the channel and they become thin and decrease in elevation in a distal direction. They also become thinner and narrower in a downstream direction and the deposits extend a few meters into the subsurface as a result of local and regional subsidence. Soils associated with natural levees have not been delineated in detail, but are described by Garofalo and Burk and Associates, Inc. (1982) as the Sharkey-Commerce, frequently flooded association. These soils are level, poorly drained, and frequently flooded.

The deposits consist of several meters of dark gray to black, watery, organic ooze or muck underlain by very soft, gray, organic clays. They occur laterally adjacent to natural levees and extend outward as flat, intratidal tracts, eventually giving way to shallow ponds, lakes, and bays. Drainage is sluggish and water exits these wetlands by way of narrow, sinuous tidal channels.

Abandoned distributaries are channels whose basic role has changed from carrying river discharge during high stages to accommodating local drainage as tidal channels. In relatively more inland settings, such as near the parent channel, distributaries will become shallow and may even become narrower upon abandonment due to sediment filling (mostly loose silts and clays) and eventual plant colonization. In relatively more distal locations where the wetlands are deteriorating, the channels will become shallow, but actually will become wider due to accelerated bank erosion. Upon abandonment, because the natural levees that flank the distributaries no longer will accrete and keep pace with subsidence, they eventually will disappear beneath sea level.

Beaches, and related longshore bars and spits, may form around the flank of an abandoned, subsiding lobe if it is exposed to sufficient wave action and currents. Such landforms develop as thin, narrow ribbons of silt with some shells, materials that are winnowed and redistributed from eroding mudflats, vegetated wetlands, and natural levees. These beaches and spits usually are very ephemeral features that often are destroyed in major storms. In the Balize complex, beaches are present only on the

south and east sides of crevasses or lobes that are exposed to prevailing winds.

Subaqueous Environments. The shallow-water *bay-sound* environment is dominated by fluvial-marine processes in which mostly silts and silty clays accumulate as a result of the erosion and winnowing of delta deposits by waves and currents (Kolb and VanLopik 1958). Bays of the Balize complex are bordered by interdistributary wetlands on the landward side and open out into deeper water environments on the seaward side. The deposits contain small amounts of shell and shell fragments and can be anywhere from a few centimeters to a few meters thick. The thickest and coarsest deposits occur in the deeper, less-protected waters. Bays may either fill or enlarge within a matter of decades depending on cycles of crevasse growth and decay.

The *delta front* environment occurs in moderate water depths (generally 15 m [50 ft] and more) seaward from bays and sounds, and covers half of the survey area. It is characterized by alternating silts, fine sands, and clays that are deposited in Gulf waters ahead of advancing distributaries of lobes or crevasses (Coleman and Gagliano 1964). The deposits are highly lenticular in plan with the nature of deposits dependent upon the pattern and rate of advancing distributaries and the amount of marine action. This environment also includes the bars that form at the mouths of major distributaries like Southwest Pass. However, because of their considerable importance to the purposes of this report, these bars are discussed separately (see below).

Still deeper waters flanking the Balize complex are characterized by the *prodelta* environment. Deposits of this environment consist mostly of soft plastic clays with some silt in the form of thin lenses or lamina. These fine-grained materials accumulate to appreciable thicknesses in relatively deep water as the first manifestation of an advancing delta, and they overlie shelf deposits that represent an open marine environment. As determined from numerous borings, prodelta deposits are the most homogeneous of all the soils associated with a delta complex or major lobe (Kolb and Kaufman 1967). According to Fisk and McFarlan (1955), they have attained thicknesses of between 61 and 122 m (200 and 400 ft) beneath Southwest Pass.

Major Passes

Bars and Bar Fingers. Distributary-mouth bars and bar fingers, which are the cumulative products of progressive seaward extension of the passes and bar migration, are phenomena unique to the major passes of the Balize complex and have been investigated extensively by Fisk (1961).

Bar formation is caused by shoaling that results primarily from reduction in the current velocities of river flow at the mouths of the passes. The shape and extent of these bars are influenced by such factors as littoral currents, tidal action, wind and waves, river discharge volume, and location of the salt water wedge (Benson and Boland 1986). Before jetty construction, the mouth of Southwest Pass was bell-shaped and the bar was located 1.6 km (1 mi) and more offshore. It maintained a general lunate shape and measured about 8 km (5 mi) wide. The bar crest was located directly out from the mouth of the pass or was offset slightly to the west, and relatively deeper water occurred at both ends. Although the bar itself did not emerge, water depths as shallow as 1 to 2 m (3 to 6 ft) did occur. After jetty construction, the bar developed as a narrow Gulf-floor bulge and constricted in width to about 1.6 km (1 mi). The front (offshore edge) of the bar has a slope of about 0.5° that, although it is quite shallow in an absolute sense, nevertheless is relatively steep as far as the delta flank is concerned.

Sediments of the current bar consist predominantly of "clean" fine sands up to about 46 m (150 ft) thick. These sands, being deposited nearer the mouth of the pass, accumulate rather rapidly, but the finer-grained sediments, being carried in an ever expanding effluent plume, become more widespread and depositional rates are significantly lower (Coleman and Roberts 1991). Bar deposits become mixed with increasing amounts of silts and clays with depth and at about 46 m, the finer-grained

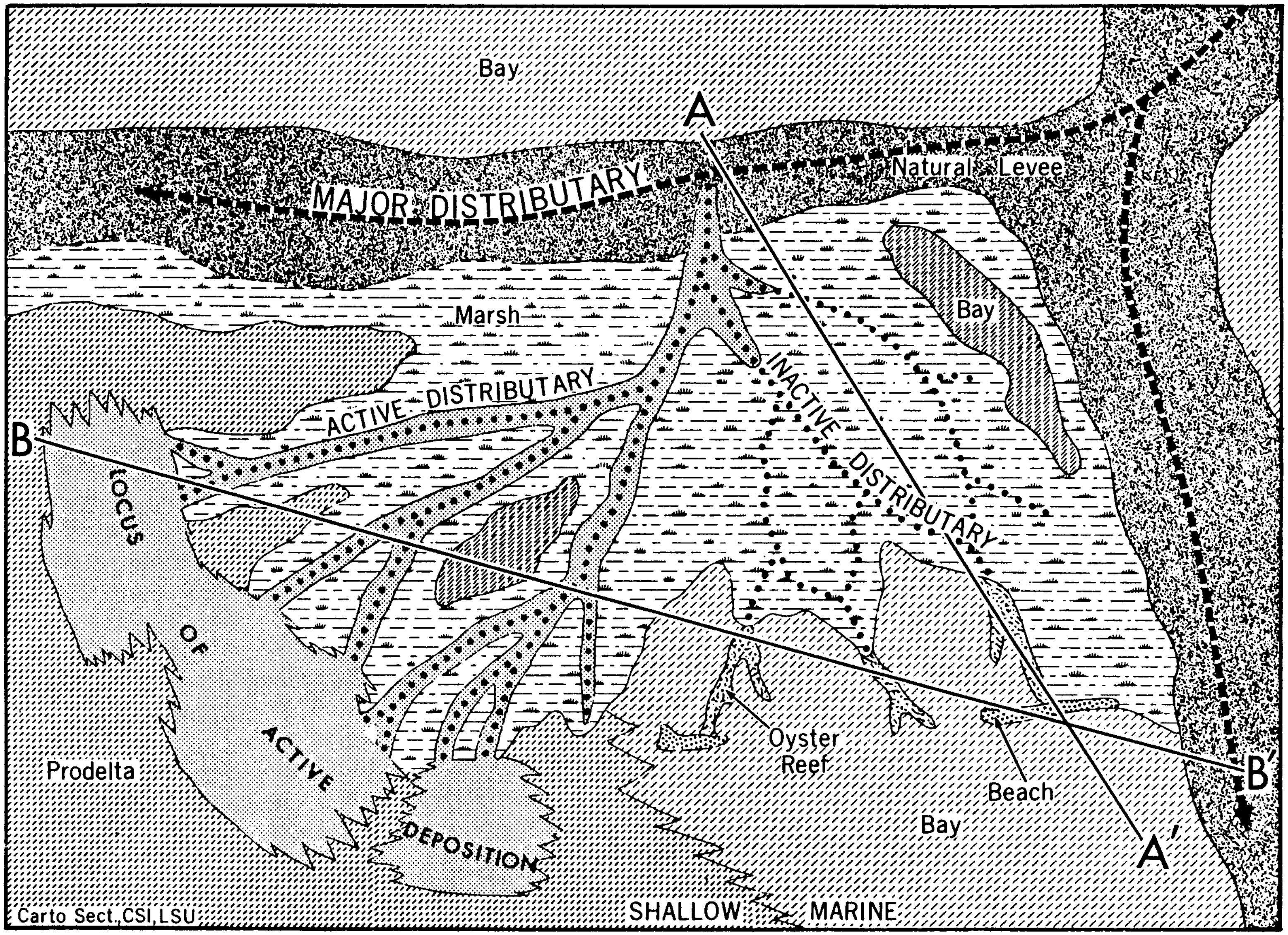

Figure 7. Sedimentary model of a crevasse system showing depositional facies. From Coleman and Gagliano (1964)

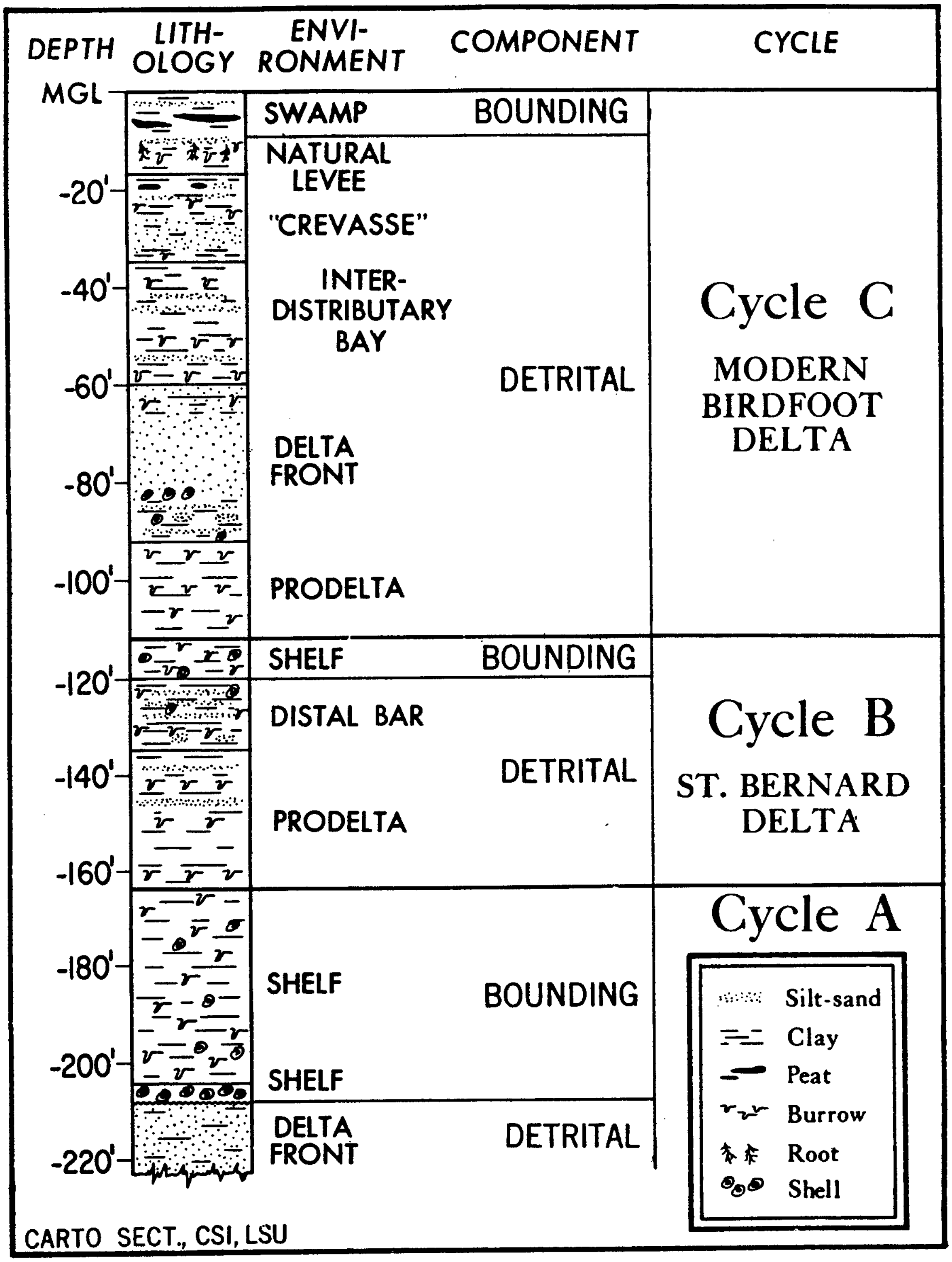

Figure 8. Generalized stratigraphy, cycles, and components of Mississippi Delta deposits as revealed in a deep boring near Fort Jackson. From Coleman and Gagliano (1964)

materials constitute about 95 per cent of their total volume. This is due to a winnowing process. During a flood, the river lays down stratified sands, silts, and clays. However, following the flood when depositional rates slow, the finer materials in the shallower waters are reworked and winnowed, leaving mostly the sand fraction.

As Southwest Pass has advanced gulfward, the cumulative bar sands have formed a finger-shaped sedimentary unit that is lens shaped in cross section, about 8 km (5 mi) wide, about 24 km (15 mi) long, and about 76 m (250 ft) thick (Figure 9). The latter dimension, about 30 m (100 ft) deeper than the present bar, reflects the effects of settlement and displacement of underlying deposits. Bar deposits have a unit weight of 2.0 whereas the underlying prodelta clays have a unit weight of only 1.7 (Morgan, Coleman, and Gagliano 1963). Hence, natural levees of the major distributaries of the Balize complex are underlain by thick sands in contrast to much thinner delta front sheet sands of smaller distributaries in shallow water. Bar formation and bar-finger growth have been major factors in the ability of the pass to resist increasing marine processes and to advance steadily into deep water.

Mudlumps. Whereas distributary-mouth bars have been a nemesis to navigators, associated mudlumps have been subjects of extensive notoriety and speculation as to their origin since the first Europeans first visited the delta area. Physiographically, mudlumps have been present within a thousand meters or so of the mouth of Southwest Pass (and other major passes as well) as scattered islands ranging in size from a few pinnacles to over 80,000 sq m (20 acres) and in elevation from 1.5 to 3.0 m (5 to 10 ft) (Morgan 1951). They are mostly elongate or sigmoidal in shape and typically exhibit fissures, vents, and springs of fluid mud. Mudlumps occur as subaqueous features as well as subaerial ones; they can emerge from bottom sediments within days or weeks (usually immediately after a major river flood); and they continually change in size and shape.

Basically, mudlumps are nearsurface expressions of diapiric (intrusive) folds of clay into and through bar deposits (Morgan, Coleman, and Gagliano 1963). They represent the plastic deformation of clays due to the load of bar deposits. Figure 10 is a schematic diagram showing stages in mudlump formation. Surficial bar deposits are the first to be extruded, but these are eroded away after several years, exposing a core of prodelta clays. Subsurface investigations have revealed that the prodelta clays are displaced upward from depths of between 107 and 122 m (350 to 400 ft).

As of 1951, Morgan reported that most mudlumps associated with the Southwest Pass were located west of its mouth along the relatively steep bar front in water depths of 6 to 18 m (20 to 60 ft). Most of these were formed before 1900 and before jetty construction. Because of the progressive buildout of the pass, other mudlumps have been incorporated into marsh deposits (interdistributary wetlands) as far north as about Burrwood. No mudlumps are known to have formed between 1900 and 1950, but there was renewed activity after that date. The present status of mudlump formation is not known.

Gullies and Mudflows. Despite slopes ranging only from about 0.2° to 1.0°, slope failures occur as bar silts and sands displace underlying plastic clays. As shown in a schematic diagram prepared by Coleman and Roberts (1991), elongate retrogressive slits (mudflow gullies and depositional lobes) form immediately seaward of the bar in water depths of 9 m (30 ft) or less. In water depths of 18 to 183 m (60 to 600 ft), the delta front is characterized by a maze of small-scale gullies and lobes (Bea and Audibert 1980). These evolve downslope into larger elongate slide gullies and fan-like mudnoses. Figure 11 provides an indication of the extent to which the seafloor off Southwest Pass has been disturbed.

Some failures occur due to seasonal bar growth (rapid deposition and loading) as slopes are oversteepened. However, based on damage assessments of offshore petroleum drilling platforms and pipelines, it is known that pressure fluctuations accompanying large

swells during hurricanes also are a major cause of mudslide activity.

Delta Chronology

Geologic events older than the last glacial maximum about 18,000 years ago are not directly relevant to the purposes of this report. The chapter in the geologic history of the area that is of initial concern is the beginning of delta plain formation. The first hypothesized delta complex is thought to have begun forming offshore from central Louisiana about 9,000 years ago when sea level was perhaps 16 m (52 ft) lower than at present (see discussion in Saucier 1994). The first complex with preserved delta deposits, the Maringouin, dates to about 7,200 years ago when sea level was about 6 m (20 ft) below present. Since that time, the plain has built up and built out by the coalescing of 14 lobes of three additional separate complexes (Frazier 1967). However, during all of that time and through multiple sedimentary cycles, the Balize complex area remained as shallow, open Gulf waters.

Virtually all workers accept the concept that the modern delta of the Mississippi River began when the river diverted near New Orleans into an interdistributary lowland between the La Loutre lobe of the St. Bernard complex to the east and the Bayou des Familles lobe of the same complex to the west (Frazier 1967). The new lobe, called the Plaquemines or Plaquemines-Modern complex, is generally believed to have begun forming about 1,000 to 1,200 years ago (Coleman and Roberts 1991; Frazier 1967; Kolb and VanLopik 1958). Since that time, it has progressively expanded southeastward past the towns of Pointe a la Hache and Buras.

Just when the Balize or birdfoot delta *per se* began to form south of Venice or the HOP is subject to debate and considerable uncertainty, despite its young age. Estimates range from as little as 200 to 250 years (Frazier 1967) to the more generally accepted value of about 500 years (Kolb and Van Lopik 1958; Russell 1936). All estimates are based largely on inference and extrapolations from the historical period rather than discrete evidence.

Part of the uncertainty stems from not knowing exactly when the delta was discovered by European explorers and what its shape and extent were at the time. The most succinct discussion of this topic can be found in Russell (1936). He reported that Vespucci may have been the first to see the delta in 1487 or 1498, and that Columbus supposedly prepared a map showing the delta in 1507. It is uncertain as to whether multiple major passes existed at the time. Most historians credit Pineda with the actual discovery of the delta in 1519; however, the event actually may have occurred as late as 1528.

At the other extreme, Thomas (cited in Russell 1936) maintained that the Southwest Pass may have started to form only in 1730. This date is consistent with estimates by Giardino (1984), who based his interpretation on interpretations of historical narratives that located the mouth of the Mississippi at Venice during the late seventeenth century and about 9.6 km (6 mi) farther southeast ca. 1712.

However, these dates seem much too recent, based on geological considerations and twentieth century data. They also do not conform to elements presented in a detailed map of the delta prepared by Talcott in 1838 (published in 1839) (Figure 12). At that time, Southwest Pass was about 24.5 km (15.2 mi) long, its mouth already was flared and shallow, and there were significant areas of interdistributary wetlands. Talcott (1839) depicted both Double Bayou (designated as Bayou B) and Joseph Bayou (designated as English Bayou) as well developed, and he pictured another lobe (undesignated and now destroyed) near R.M. 2.5 below HOP on the right descending bank opposite Fishermans Bayou. Finally, his depiction of tree growth along the distributaries of the lobe suggests that well-developed natural levee ridges already had formed.

Estimates of the rate of growth (buildout) of Southwest Pass are reasonably consistent. Russell (1936) cites several sources that suggest an average rate of growth of 87 m (285 ft) per year during the eighteenth century. Giardino (1984) cites others that yield an average value of 78 m (256 ft) per

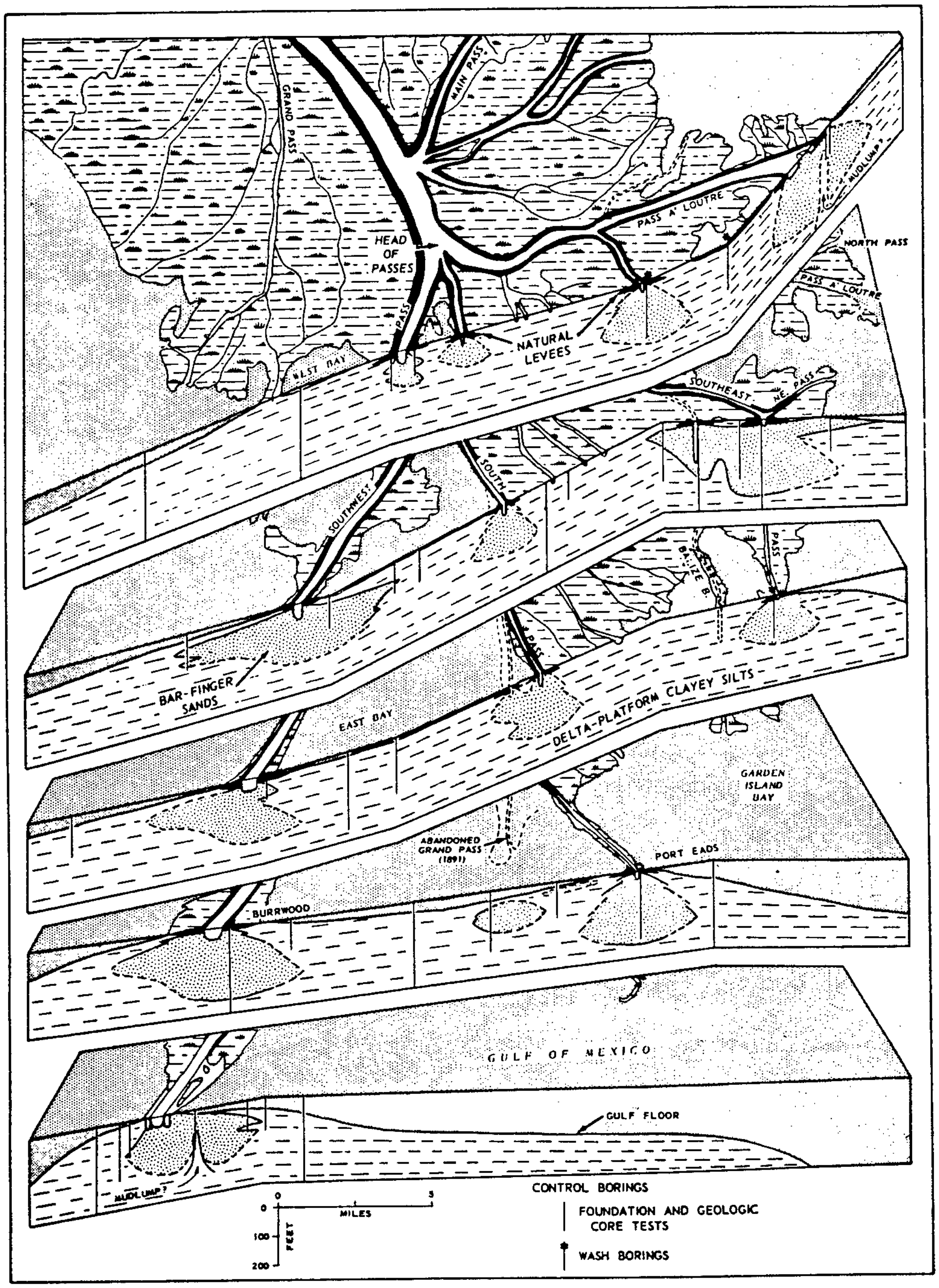

Figure 9. Occurrence of bar finger sands in the Balize delta complex. From Fisk (1961)

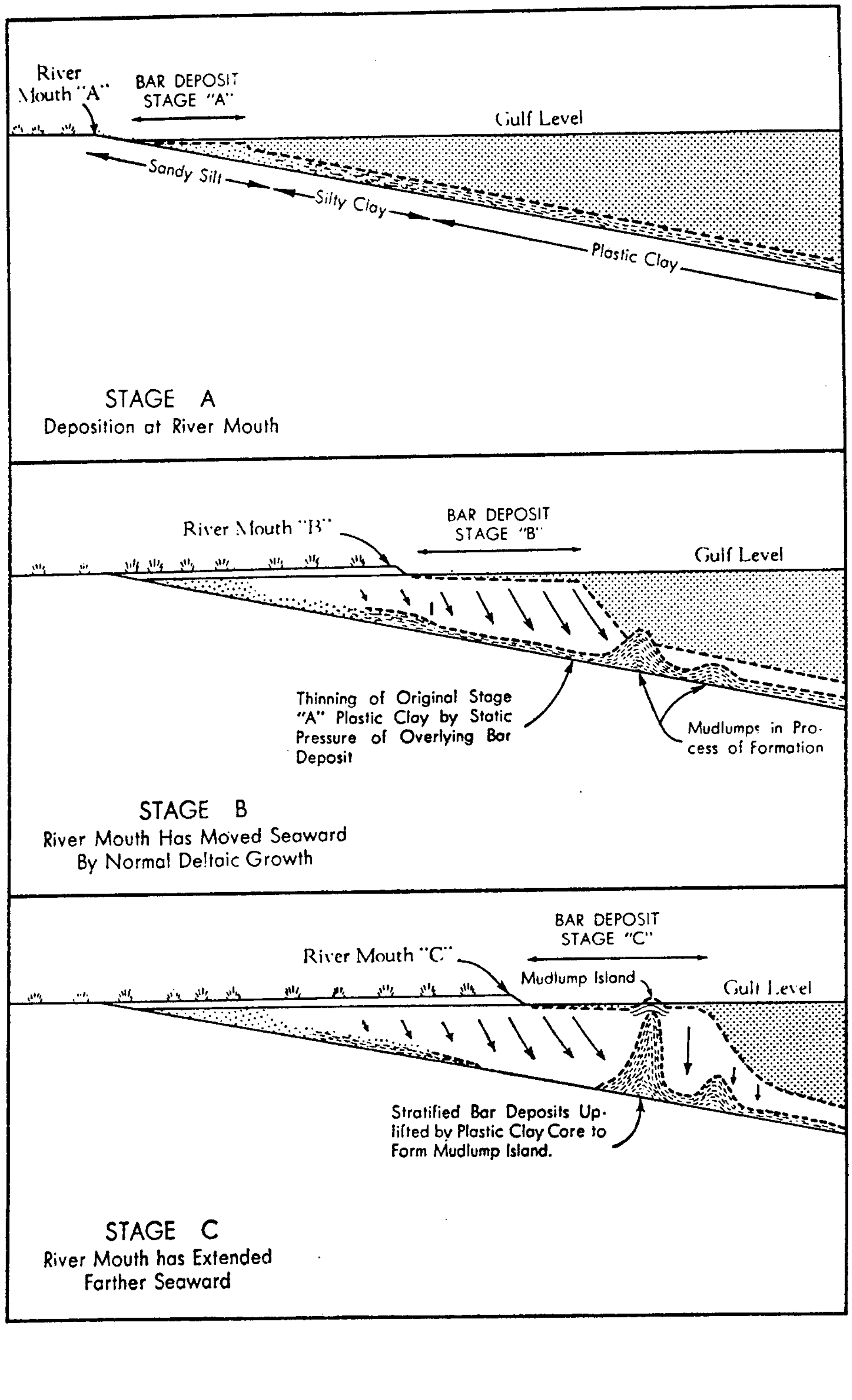

Figure 10. Schematic diagram showing relationship between bar growth and mudlump development. From Morgan (1951)

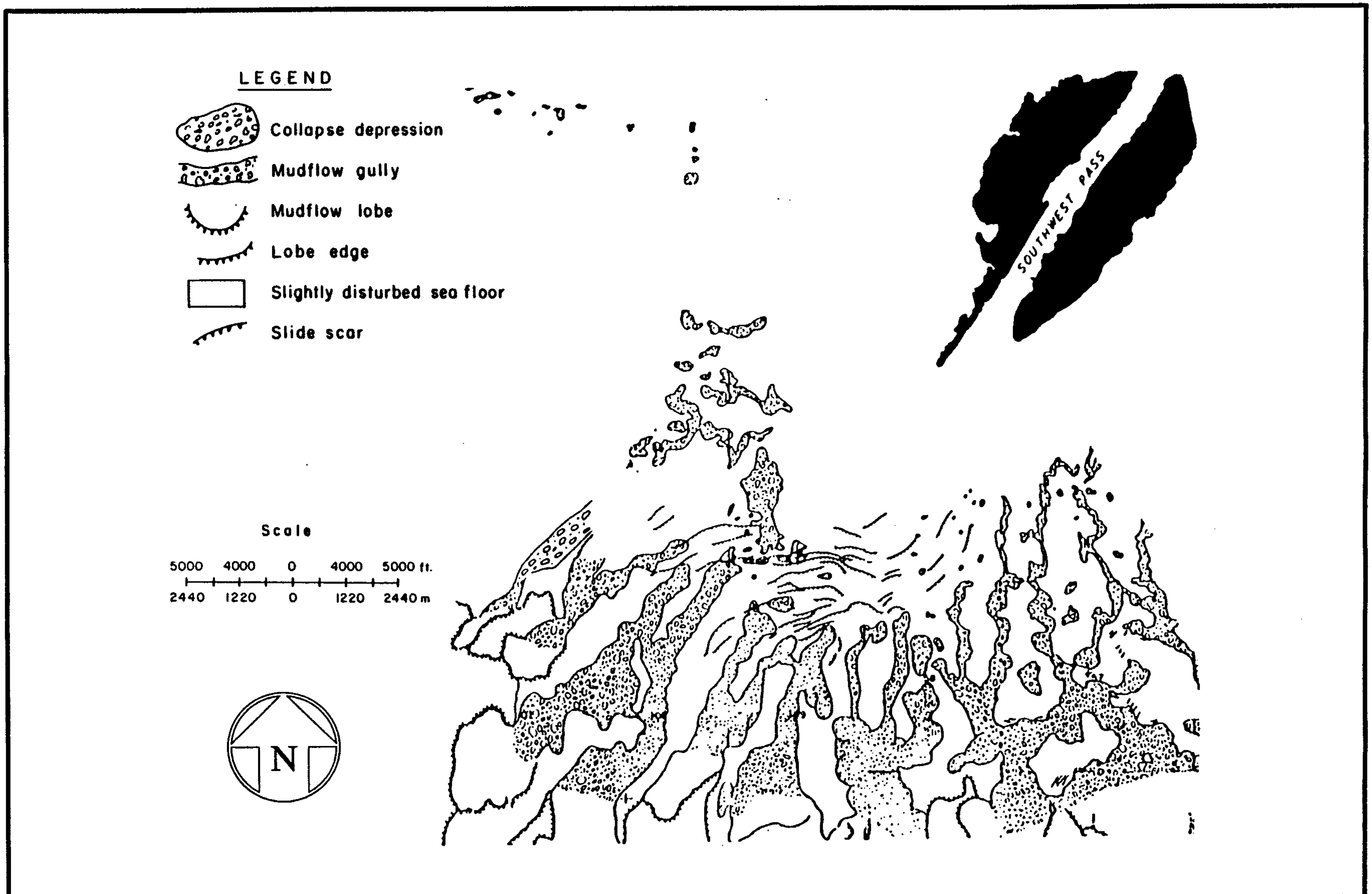

Figure 11. Seafloor features in the vicinity of Southwest Pass. From Bea and Audibert (1980)

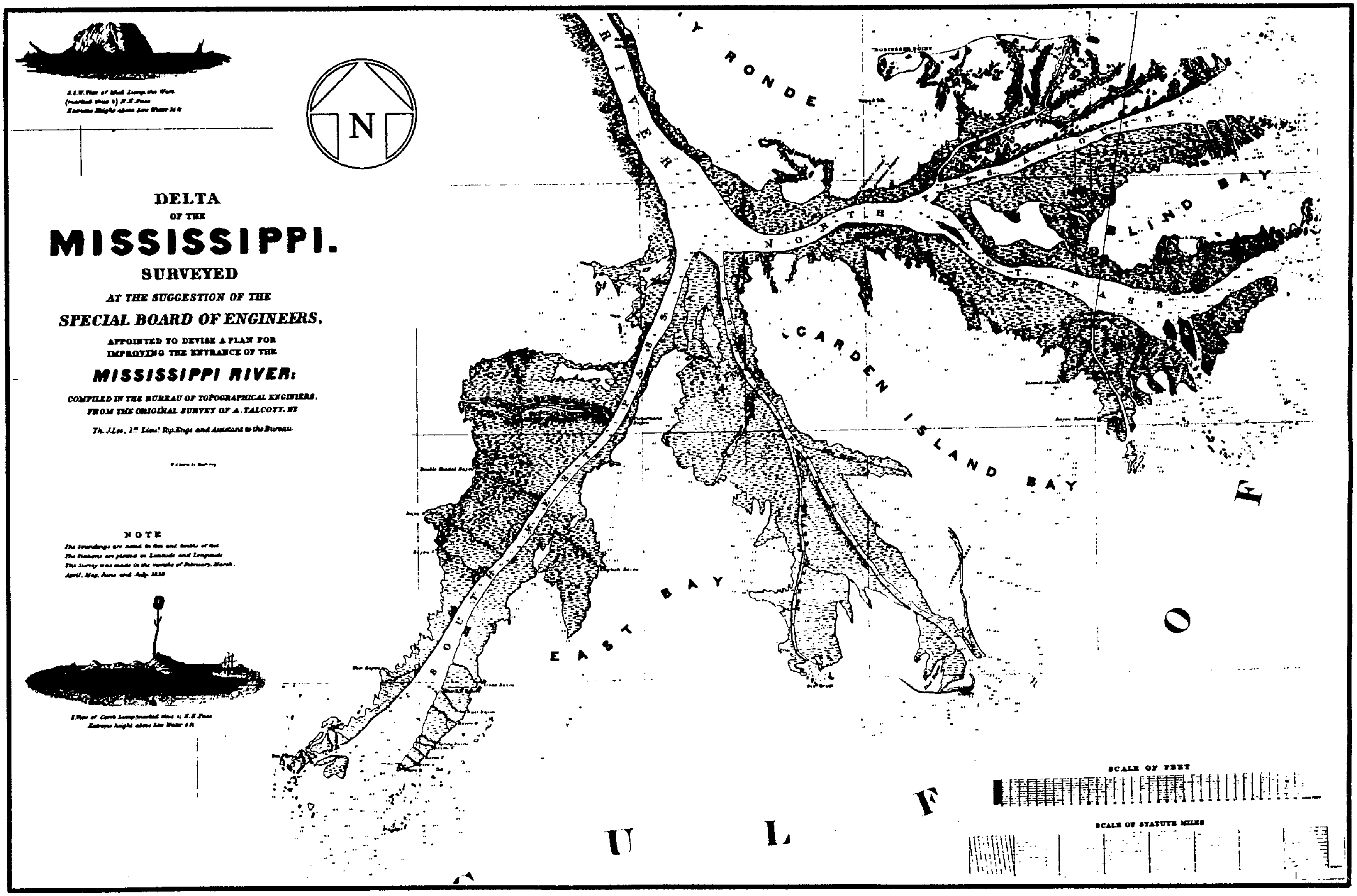

Figure 12. Excerpt from Talcott's 1838 map of the delta of the Mississippi River

year for the nineteenth century. More recent data compiled by Coleman and Roberts (1991:Figure 13) show the progradation of the mouth of the pass by means of the plotting of the -10 m (-33 ft) contour from surveys dating from 1764 to 1979. This contour represents the front of the bar. The results indicate a rate of growth of about 69 m (226 ft) per year over the 215-yr period. This rate is appreciable, but it still is less than the rate of growth of many distributaries in shallow-water lobes.

Archeological Implications

Aside from cultural considerations, three factors are involved in the possibility that prehistoric and historic cultural resources may be located and preserved in the Southwest Pass ODMDS area. These include the nature of the depositional environment or landform, the geomorphic processes at work, and the age of the deposits. As explained below, all three factors indicate that significant resources of any type are exceedingly unlikely to occur.

During prehistoric times, the only suitable land for habitation, even on a temporary basis, would have been the natural levee ridges of distributaries. These are quite limited in areal extent and in a general environment that is subject to periodic inundations by both river floods and hurricanes; during such events, aboriginals would have had to vacate the Balize delta complex completely. Otherwise, use of the area would have been limited to brief hunting, gathering, and fishing forays. Use of the area during historic times would have been subject to the same constraints; facilities related to petroleum extraction, commerce, and other activities would have had to be "hardened" to withstand adverse weather events.

Any remains of human use and occupation of any age would have been subjected to the high (approximately 15 mm/year) subsidence rates prevalent in this environment; even those a few decades old likely would be buried by alluvium. By way of example, a Spanish magazine was constructed in 1734 near the settlement of Balize on Balize Bayou off Southeast Pass (Russell 1936). It was destroyed by a hurricane in 1778. Only the tops of the magazine were visible in the late 1800s and no traces remained above marsh level in 1936.

Concerning historic-period vessels that might have sunk in or at the mouth of the pass, these certainly will be buried by channel or bar deposits and possibly even natural levee deposits. Accretion has occurred both as narrowing of the pass and seaward buildout, especially construction of jetties. Off the flank of the bar, subaqueous failures could cause wrecks to migrate downslope into deeper water. Bea and Audibert (1980) documented the fact that mudslides triggered by hurricane waves and swells were quite capable of rupturing pipelines and overturning offshore drilling rigs.

It should also be remembered that Southwest Pass was not the favored entrance to the river before this century. Because of their smaller bars, the Grand-Tiger and Main Passes were favored in earlier times. Southwest Pass did not achieve its prominence as a navigation channel until after the jetties were constructed.

Despite the nature of the landscape and the geomorphic processes at work, it can be stated with certainty that no prehistoric archaeological sites will be found in the Balize complex. The deposits simply are too young. Under the most liberal interpretation of delta growth rates, it is possible that protohistoric sites could be present as far south as the HOP, but none have been found because surely they would be buried. Russell (1936) estimated that the southern limit of Indian mounds was near Buras (river mile 25 above HOP) and subsequent work by McIntire (1958) has affirmed this. The nearest known site is a Mississippian (Plaquemines Culture) shell midden located along the Gulf shoreline about 32 km (20 mi) northwest of Southwest Pass.

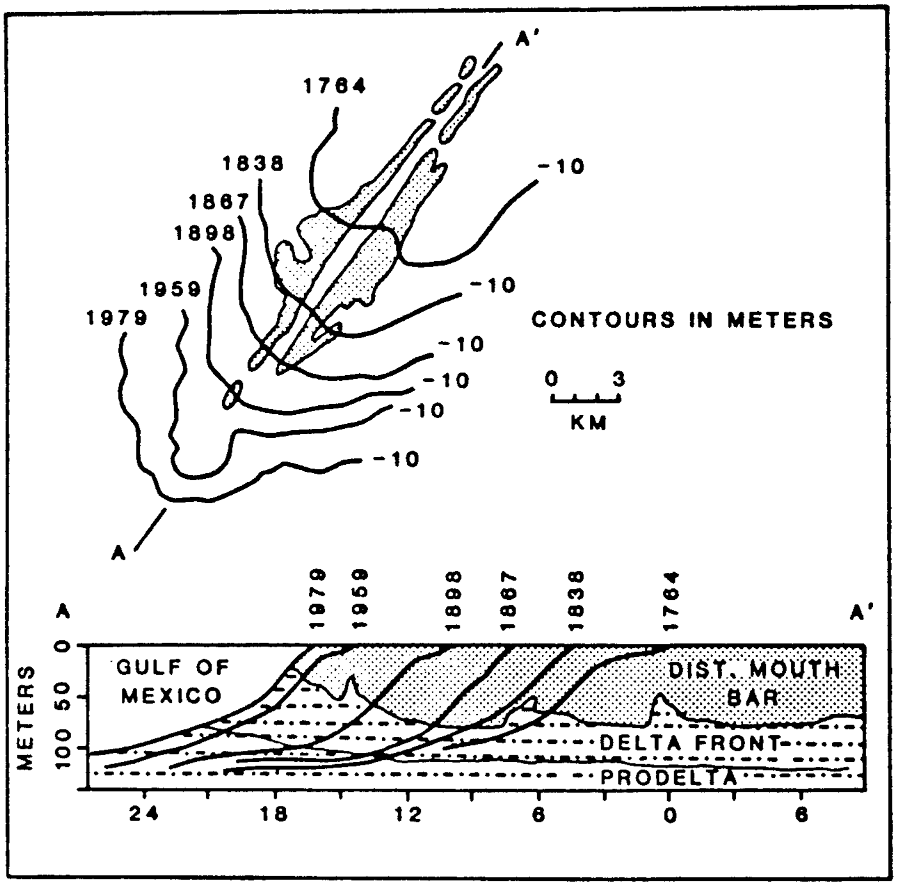

Figure 13. Progradation of the mouth of Southwest Pass during the period 1764 to 1979. From Coleman and Roberts (1991)

CHAPTER III

THE PROJECT CORRIDOR IN HISTORICAL PERSPECTIVE

Introduction

The Southwest Pass today serves as the Mississippi River's principal outlet to the Gulf of Mexico, but this vitally important channel dates only from the early twentieth century (Secretary of the Army 1996:11-2; Bragg 1977:268). Prior to its development, navigators of large vessels struggled, often unsuccessfully, to utilize the numerous other passes that extend like muddy fingers into the Gulf of Mexico. This chapter briefly summarizes the complex early history of the passes, and the modern engineering effort at the Southwest Pass.

Historical Setting

French Explorers and Colonists, 1682-1766

During an expedition from Canada down the Mississippi, René Robert Cavalier, Sieur de La Salle, discovered the mouth of the river in 1682. He noted that it flowed into the Gulf of Mexico through three channels. After claiming the entire Mississippi Valley for France, La Salle returned by river to Canada. Although he recorded the navigational position of the river's mouth, some historians believe that he calculated inaccurately. Whatever the case, when he attempted to return to the site, this time through the Gulf of Mexico, he could not locate the river. After numerous misadventures on the Texas coast, he was murdered by his own crew (Wilds et al. 1996:2-4).

Pierre Lemoyne, Sieur d'Iberville, rediscovered the mouth of the river for France in 1699. When he first entered the passes, he observed what appeared to be black rocks and petrified trees in the waterway, but he discovered, on closer inspection, that these objects were in fact mud lumps (McWilliams 1981:137-138). Although the French intended to fortify and colonize the mouth of the river, the marshy inhospitable land on the lower reaches of the Mississippi initially discouraged them. Until the founding of New Orleans in 1718, the French concentrated their efforts at settlement in the vicinity of Mobile rather than along the lower reaches of the Mississippi (Wilds et al. 1996:8-11).

From the first, attempts by the French to navigate the passes, shoals, and sand bars presented daunting problems. The river grew sluggish at the passes, and as it decreased its velocity it deposited an immense amount of sediment at the river's mouth, thus "creating a shoal which reduces the depth of navigable water at the most crucial point of the whole river system" (Clay 1983:22).

Preferred over the Southwest Pass and the project corridor extending from the mouth of the Pass, the Southeast Pass served as the principal point of entry into Louisiana during the entire colonial period. In an attempt to guard the mouth of the pass, the Chief Engineer of the French colony of Louisiana, Pierre Blond de la Tour, established a fort on a small island. The fort served both as a military installation and as a lighthouse. The installation was known as the "Balise," meaning "beacon" or "buoy" in French. The anglicized corruption of this word, "Balize," has been in general usage at least since the Civil War (Lincoln 1983).

The French contended with but never solved the problem of the shoals. Initially, they

found the average depth of the passes to be about six to eight ft, which provided sufficient depth only for small craft to cross the bar. To deepen the passes, the French in 1726 initiated a process known as harrowing, by which ships would drag iron harrows along the bottom of the outlets in order to break up sand bars. This method provided temporary deepening of the channel but proved ineffective in supplying a permanent solution, because the sand bars and shoals soon re-formed (Clay 1983:22).

In the meantime, the fortifications at Balise slowly sank into the mud. By the 1760s, the French had reduced the stronghold to a small battery with several cannon (Lincoln 1983:338). Balise nevertheless served as the site where France officially transferred the colony of Louisiana to Spain in 1766 at the conclusion of the Seven Years' War (known in America as the French and Indian War).

Maritime Context

The history of French Louisiana and its maritime culture is predated by the Spanish who came almost 200 years earlier to the region. They were the first Europeans to sail the Gulf: Sebastian de Ocampo in 1508, and Alonzo Alvarez de Pineda in 1519 (Weddle 1985). The era they initialized for Spain lasted for three centuries, and saw Spain increase its exploitation of the entire Gulf region from Vera Cruz to Havana. Spain's hegemony of an unbroken and uncontested expanse of territory in the Gulf lasted until 1699 with French colonization of the Louisiana Territory (Hoffman 1980).

By 1521, Mexico had been conquered and the newly acquired territories in the Gulf of Mexico were renamed *Nueva España*. The Gulf remained a Spanish sea for 300 years. Trade centers for supplies to Europe were formed at the mouths of rivers and embayments where ships had easy access to the goods produced in the interior. From the interior, caravans of Indians and mules were employed to take the spoils of the New World to ships waiting, for example, at Vera Cruz, for the trip back to Spain; Vera Cruz became the principal port for gold and silver extracted from the mines of central Mexico. Other Spanish trade centers around the Gulf were at the Mississippi River, Mobile Bay, Pensacola, Tampa, Biloxi, and Galveston. On the way back to Spain, Havana became the principal assembly point for the New Spain and Terra Firme fleets for the final leg of the journey home.

The course taken by the ships through the Gulf returning to Spain during this period was north-northeast or northeast, the trade centers laying along a natural maritime route determined by summer southeasterly tradewinds and the Loop Current. During the day the ships sailed northward and needed to be in sight of land only occasionally to determine how far to be west of shore (Coastal Environments, Inc. 1977).

By the mid-sixteenth century merchant vessels began to sail in convoys protected by warships (Hamilton 1934). The new larger ships also abandoned the old routes and began to sail through the Straits of Florida on their way back home to Iberia. From 1519 to 1699, Spanish fleets increasingly crossed the central Gulf on their way to Havana and then to Spain (Weddle 1985, MacLeisch 1989). Eventually the Gulf route became fixed because of favorable currents and winds and because of need for protection from pirates. These routes remained in use until the French entered the Gulf in the late 1600s.

The vessels used during this period of history in the Gulf of Mexico either were built in Europe or were of European design. They were classified according to the hull form, rig or sail plan, and a combination of rig and sail (Wilson 1983). Information on smaller vessel types does not appear until 1688 (Chappelle 1951).

According to Garrison et al. (1989) caravels, galleons, naos, sloops of war, corvettes, pinasses, and flutes sailed the Gulf's coasts during the Spanish Period. Beginning in the 1500s, the Spaniards arrived in caravels in the Gulf--the type used by Columbus to sail to America. They were small and fast ships of between 35 to 100 tons. By the mid-1500s Spain developed larger vessels (300 to 600 tons), three or four masted galleons and naos, to carry New World treasures back to Spain. Both the galleon and the nao were of similar design, with galleons heavily armed and

designated a military vessel while the naos had far fewer cannons and were used as merchant vessels. Although ship types were bulky and top heavy, and had high front and rear sections, they were used well into the seventeenth century. Subsequent design changes in the late sixteenth and seventeenth centuries by the Dutch, reduced the high sterncastle of the galleon making it less top heavy; the French gave the galleon a broader and more stable hull, reduced the number of cannon, and placed them higher to reduce the possibility of water entering from the side of the ship (Singer 1998:12-14).

In the 1600s, a two-masted, square-rigged vessel, known as the Sloop Of War, or the Corvette by the French, appeared in the Gulf. Although used as a war vessel, in the early 1700s the sloop most commonly functioned as a merchant ship in the West Indian and coastal trade. Also in the seventeenth century, the French used the pinnace in the Gulf. It was a cargo ship with 10 to 12 cannon and three masts with square sails (Singer 1998:14-15).

The French fort established in 1702 on the west bank of the Mobile River gave them access to the northern coast of the Gulf of Mexico. The French developed new routes to their trade ports at Biloxi, Pensacola, Mobile, and New Orleans from their harbor on Dauphin Island. When the British won the territory east of Mississippi from the French and Spanish Florida from Spain, Pensacola became their capitol for their West Florida colony. Mobile was almost abandoned by the 1760s except for a few plantation owners who continued to produce and ship some goods.

The Passes Under the Rule of Spain, 1766-1803

Like the French, the Spanish continued to use the Southeast Pass as the chief gateway to the colony of Louisiana. Furthermore, Spain granted to a chief pilot who resided at Balise the exclusive privilege of controlling the entry and exit of ships that attempted to trade with New Orleans and points along the river. The monopoly enjoyed by the pilot annoyed commercial interests that resided in the Crescent City. In the meantime, the passes remained as perilous to navigate under the Spanish as they had been under the French (Goodwin et al. 1985:47-50).

Maritime Context

By 1800, warships and merchant ships had three masts (fore, main, and mizzen) and the number of square sails on the fore and main masts increased from two to four or five. Ship profiles also changed. The height of the fore and sterncastle was greatly reduced while the sterns of larger vessels changed from square to round by the early 1800s. After the 1760s, British vessels began to use bronze and copper sheathing below the waterline; the technique was employed by French and American ships starting in the 1790s (Wilson 1983).

The English introduced a new vessel type, the West Indiaman for trade in the New World. Smaller and faster than the East Indiaman used in the Far East, it became popular in the mid-1700s. Well armed and ship-rigged, it averaged between 150 and 400 tons. Another sailing warship developed during the mid-1700s was the frigate, which carried 20 to 30 guns, a compliment that increased eventually to 50 or 60 (Singer 1998:15).

Other changes in ship design included replacing square-rigged vessels with two-masted brigs, brigantines, and schooners. The schooner appears to have been developed in the Netherlands in the early seventeenth century and was introduced into the United States in the late seventeenth century. Because the schooner required a much smaller crew than the earlier larger vessels, the schooner became the most popular American two-masted rig by the end of the eighteenth century (Singer 1998:15).

The Passes Under American Rule, 1803-1852

Spain actually ceded Louisiana to France in a secret treaty of 1800, but the Spanish provided a *de facto* government for the colony until 1803, when the territory was purchased from France by the United States. Under American rule, trade on the Mississippi River increased rapidly, particularly after the

development of the steamboat, which could move upstream against a strong current.

However, although steamboats transformed New Orleans into a major American port, the outlet through the passes to the Gulf of Mexico remained a vexing problem. The Southeast Pass had provided the preferred gateway to the river during the colonial period, but it was replaced by the Northeast Pass early in the nineteenth century. All the passes presented problems to navigation, and harrowing continued to be the only method used to break up the sand and shoals at the mouth of the river. In 1835, however, Congress approved an appropriation of $250,000 to conduct dredging at all the passes, including the Southwest Pass, where the project corridor is located. This appropriation represented the first use of federal funds at the mouth of the Mississippi. Almost the entire appropriation was expended on surveys and on the construction of a dredging apparatus, a vessel called the *Belize*, that experienced numerous mechanical difficulties and never functioned properly.

During the 1840s, a lively debate developed on how to deal with the problem of the shoals and sand bars at the passes. Various dredging techniques were advocated, the use of drydocks to carry ships over the sand bars was suggested, and the sealing of all but one of the river passes was proposed (Clay 1983:23). While the debate was proceeding, the Northeast Pass (then the favored route) filled with shoals. As a result, the Southwest Pass, and the waters leading to the mouth of the Pass where the project area is located, assumed a new importance, as did a community on the pass known as Pilot Town, where the pilots had their headquarters (Gould 1889:314).

Maritime Context

During this period the number of ports increased along the Gulf coast to handle increased commercial activity from local sugar plantations, truck farmers, and illegal privateers. Export of lumber, grain, and cotton products also increased the use of vessels throughout the local water systems of the Gulf. The use of these raw products from Gulf ports grew along the eastern seaboard and in Europe. A "golden age" of merchant marine shipping evolved in the Gulf, wherein new shipping lines developed a commercial triangle which connected Gulf ports to New York and then to Europe (Coggins 1962).

The steamboat ushered in the era of powered shipping and an era of cheaper transportation of goods. By the 1830s, it was cheaper to ship cargo between the lower Ohio Valley and the East Coast via New Orleans than via land routes over the Appalachian Mountains. In the 1870s, railroads surpassed river transportation as the chief means of transporting goods in and out of the central United States. Transportation by vessel on the Mississippi grew again in the early twentieth century with the rise of barges, especially for specialized bulk cargoes. In 1812, the first steamboat on the Mississippi River was the *New Orleans*.

By 1806, a feudal society was taking shape in the larger communities of the coastal region. By the mid-1800s, four million slaves had been imported. More than 5,000 boats sailed down the Mississippi River or across the Mississippi Sound from Mobile, Pensacola, the Sabine River, Pensacola, or Galveston to bring cotton to the wharves at New Orleans—New Orleans had become the Queen City of the South. Into this region "wealth poured in from the mid-continental United States and from all over the world" (Coastal Environments, Inc. 1977:67).

Compared to earlier historic periods, the American Period of maritime history in the Gulf saw major design changes and the development of distinctive regional vessel types. Technologically, masted ships were improved to produce swift vessels and eventually became more powerful with the introduction of engine power and steel hulls. The regions of technological innovation were centered in the Chesapeake Bay and, in mid-century, in New England.

Impetus to improve the swiftness of ships came from an environment of instability surrounding American shores during this time: there was no Navy to protect domestic ships, international conditions were unstable, and smuggling was a profitable trade. Consequently, small, fast vessels most often

were employed through dangerous waters. For example, the "West Indies," sloop, developed in the previous period of history, was modified with a schooner rig and with raked masts. From the "West Indies" two further types were developed: one used for coastal trade, and the other a larger deep water vessel. By 1820, the larger schooner type became known as the "Baltimore Clipper," and by the mid-1850s shipyards in Philadelphia, Boston, New York, and other New England yards began building larger clipper ships, some as long as 190 ft. They reached their production peak between 1853-1854. At the same time vessels larger than schooners also were being built with more iron and steel. A number of factors brought the production of large clipper ships to a halt, which also ruined the shipbuilding industry in the United States: the depression of 1857, the Civil War, and competition from the railroads (Wilson 1983).

Developments Related to the Southwest Pass, 1852-1898

Although the Southwest Pass had become the favored gateway to the Mississippi, more than 40 vessels were grounded in 1852 for periods ranging from two days to eight weeks on the bar just outside the pass. To get off the mud lumps, the vessels had to lighten their loads, sometimes by throwing cargo overboard (Gould 1889:315).

In that year, Congress responded to the problems at the pass by appropriating $75,000 for improvements at the mouth of the river. The legislation also created a board of Army officers to study the situation at the passes and to make recommendations about increasing the depth of the water at the bar. Unsure that any one method would prove effective, the board recommended several alternatives: dredging a channel; constructing parallel jetties at Southwest Pass; and, finally, building a ship canal at Fort St. Philip that would extend from the river into the deep waters of the Gulf of Mexico (Gould 1889:315). At first, dredging was attempted, and by 1853, the Southwest Pass had been deepened to 18 ft. However, by 1856, no trace of the deepened channel remained (Gould 1889:315).

With the failure of dredging, the Federal government appropriated $330,000 for jetties. A commercial firm built a jetty on the east side of the Southwest Pass. Combined with a program of harrowing and dredging, the effort maintained a depth of 18 ft in the channel through 1859 and 1860. In spite of these promising initial results, the program actually seems to have increased and accelerated the shoaling of the pass, rather than decreasing it. On the eve of the Civil War, 35 ships were waiting outside the bar to enter the Southwest Pass, three vessels were grounded on the bar, and inside the river, merchandise waiting for export lay rotting in warehouses (Morgan 1971:130).

During the Civil War, the passes assumed critical strategic importance; controlling the entire course of the river was established as a major military objective of the Union. Very early in the war, the Federal forces initiated a naval blockade of the Confederacy at the mouth of the river. The Confederates placed obstructions in the channel to defend the entrance to the river. A vessel in the blockading fleet, the U.S.S. *Richmond*, struck a submerged wreck on the inner bar of Southwest Pass in late September, 1861 (Stewart 1903:690). A few days later, the U.S.S. *Vincennes* collided with a sunken vessel that blocked the channel (Stewart 1903:696). However, more than a century of erosion and dredging seem to have eliminated these obstacles; present day shipwreck databases record no such obstructions from the Civil War era.

In October 1861, a Federal blockading fleet actually entered the Mississippi in order to establish a battery at the Head of Passes, but Confederate vessels succeeded in driving the Federals from the river. In retreat, several Federal vessels became stuck on the bars at the passes (Bragg 1977:268-269).

The blockading fleet nevertheless tightened its control of the mouth of the Mississippi. The Louisiana Division of Archeology shipwreck database records the mishap of the *Julia*, a Confederate blockade-runner, that was forced aground by a Federal vessel at the mouth of the river on January 24.

According to Raphael Semmes, the celebrated Confederate naval commander, the pilots along the coast of the Confederacy "were, with few exceptions, Northern men, and as a rule they went over to the enemy, though pretending, in the beginning of our troubles, to be good secessionists" (Semmes 1869:110). These pilots guided Commodore David C. Farragut through the passes in April 1862, when he led a fleet of 40 Federal vessels into the Mississippi River. Steaming by the Confederate defenses at Forts Jackson and St. Philip (above the Head of Passes), Farragut's fleet ultimately captured New Orleans in one of the most significant Federal victories of the Civil War.

Following the war, efforts to clear the Southwest Pass resumed. In 1868, the Corps of Engineers put into operation a dredging ship that initially appeared to break up the sand bars; however, the Corps eventually learned that sand bars could be cleared only if the dredging were undertaken continuously, a process that involved sizable difficulties and expense (Clay 1983:23).

By the 1870s, dredging had come into disfavor, and the construction of a canal was promoted by the Corps of Engineers. An alternative, and less popular, solution was advocated by James B. Eads, who proposed to jetty the mouth of the Southwest Pass in order to maintain and deepen the channels. A debate of considerable historic importance ensued on the question of whether jetties or a canal should be utilized (Pearson et al. 1989:184-185).

Congress resolved this historic debate with a compromise. Like many compromises, it included some unwise provisions. Eads was permitted to experiment with his jetties, but he was forced to do so at the much smaller South Pass rather than the Southwest Pass, which he considered the logical choice. He was required to deepen the South Pass to 30 ft and maintain it for 20 years. If his experiment failed, he would have to shoulder a heavy financial burden by himself; if he succeeded, he would receive eight million dollars (Dorsey 1947:167-178; How 1900:77-104).

Eads took the gamble. Already in his career he had invented a diving bell with which he made a fortune retrieving cargo from sunken steamboats; he had helped the Union gain control of the Mississippi River during the Civil War by building a fleet of armor-plated steel gunboats; and, in 1874, he had completed a bridge (that still stands today) across the Mississippi River at St. Louis. The jetties at the South Pass proved to be his most difficult task, but he achieved his goal.

Eads' experiment at the South Pass proved to be such a success that exports from New Orleans increased 2,600 per cent between the beginning and the completion date of the construction of the jetties (Dorsey 1947:216). Furthermore, New Orleans moved up from eleventh to second place among American ports within five years of the jetties' completion (Morgan 1971:167). As a result of Eads' experiment, the South Pass became the major navigational gateway to New Orleans between 1879 and ca. 1914 (Pearson et al. 1989:185).

The increased commerce through the small South Pass created a demand for a larger channel. As Eads had argued with no success in the 1870s, jetties could be much more effective at the Southwest than at the South Pass (Bragg 1977:268-269). In 1898, the government at last recognized the need to open a new channel in the Southwest Pass.

Maritime Context

During the Civil War normal commerce stopped in the Gulf of Mexico because of the Federal naval blockade imposed on Southern ports, and because bigger profits were to be made by illicit traders running the blockade. The Civil War spurred the development of new ship types. The older coastal shipping vessels disappeared, and new, swift, low-silhouetted sailing schooners and steam vessels appeared. These were designed to make quick runs from Havana, Bermuda, and Nassau for Brownsville, Galveston, New Orleans, Tampa and Mobile. The illicit commerce of the Civil War came to a close when the war ended (Coggins 1962). Confederate blockade runners were occasionally run aground by Union ships. And one of the most important naval conflicts of the war, between the Union Monitor and the Confederate Merrimac in Mobile Bay, marked the end of wooden warships and the

introduction of ships sheathed in iron (Coastal Environments, Inc. 1977).

After the war and the period of reconstruction in the Southern States, commerce shipping again appeared along the Gulf coast, but this time with a large foreign element. The new post-war traffic moved along coastal and direct routes to South America, Europe, the Caribbean, and the eastern U.S. markets. New York no longer controlled the Gulf's commerce (Laing 1974). Although, coastal maritime transportation was restricted by law to U.S. vessels during the latter part of the nineteenth century, the American merchant marine never recovered its pre-Civil War status. Due to the effects of Confederate raiders, lost markets, and increased costs coming from insurance, crews, and ship building. A greater-share of Gulf trade was captured by foreign merchants from Norway, Britain, Denmark, Holland, Germany, Italy, and Columbia. These new players defined new traffic patterns to Gulf ports. Together with lumber, grain and cotton, the raw materials of the Gulf region were shipped through Yucatan and the Bahama Channels.

After the Civil War, shipyards in New England took the lead in developing and perfecting the "down-easters" by 1885. They were over 190 ft long, but carried less sail than the clippers, had stronger sheer, and bore less decoration. But by 1900, they too were replaced by the newer technology of steamers, railroads, and smaller schooners that carried on coastal trade (Wilson 1983).

In the Gulf, small coastal vessels (rigged as a sloop, schooner, brigantine or brig) carried on trade with other ports of the United States. Foreign vessels were prohibited in United States coastal waters after March 1, 1817. After this date the use and numbers of small coastal vessel increased as did all of the United States' merchant fleet.

The large amounts of timber and coal being produced in Gulf States were largely exported in schooners. Some of the schooners reached 300 ft in length. With the introduction of iron and steel in shipbuilding, composite vessels of metal frames with wooden decks and masts were produced. The first iron-hulled schooner appeared in 1880. Completely wooden ships still were being built until World War I when the demise of sailing craft occurred. Coastal trade was carried on in wooden schooners until after World War I because they were inexpensive to build and maintain (Wilson 1983).

Until the competitiveness of railroads destroyed much of sailing's attractiveness, passenger ships were considered more comfortable, faster, safer, and cleaner than wagon travel. Sailing passenger vessels remained popular until the last quarter of the nineteenth century (Wilson 1983).

Engineering Efforts at the Southwest Pass, 1898 to Present

Efforts to create a modern channel for ocean-going ships through the Southwest Pass date from February 1898, when Congress authorized the Corps of Engineers to conduct a survey on the practicality of securing a 35 ft channel of adequate width through the pass. Completing the survey within a year, the Corps submitted a report favorable to such a channel on January 7, 1899 (Chief of Engineers 1899:1863).

Having set the wheels in motion, Congress insured that they turned very slowly. In the River and Harbor Act of 1899, Congress appointed a Board of Engineers to review the report that the Corps submitted. The especially appointed Board then submitted its review in a report of January 11, 1900 (Chief of Engineers 1900:2287-2302). The review recommended that a channel 1,000 ft wide and 35 ft deep be established at the Southwest Pass. The following recommendations also were included among its many provisions: 1) construction of two jetties at the mouth of the pass; 2) employment of additional dredges; and 3) the purchase of land adjoining the jetties for use as storage depots and a maintenance plant (Chief of Engineers 1901:383).

The River and Harbor Act of June 13, 1902, officially authorized the Southwest Pass project. Initial estimates indicated that the ship channel would be completed in three years after the funds were made available. The entire project was estimated to be completed in 5 years (Chief of Engineers 1902:315-316).

These estimates proved to be optimistic and inaccurate.

To implement the act, the government began negotiations to acquire all the land below, or south of, Pilot Town on the east bank, as well as all the land below the United States lighthouse reservation on the west bank of Southwest Pass. When the owner, George Jurgens of New Orleans, insisted on a selling price of $250,000, the Secretary of War authorized the local United States district attorney to begin condemnation proceedings. The day after the proceedings were initiated, Jurgens agreed to accept only $5,000 for the property and to pay for certain court costs (Chief of Engineers 1903:1277).

The government initiated construction on the jetties in December 1903. The work was completed in 1908, but an extension of the jetties was begun in 1909 (Chief of Engineers 1909:440). In the meantime, dredging operations commenced in April 1905. To serve the dredges operating in the pass, the United States established a coaling station and wharf on the east bank of the Southwest Pass at Mile 15 Below Head of Passes (BHP) in 1908. Known as Burrwood, the base subsequently expanded to included residences, administrative and industrial buildings, and numerous other structures (Goodwin et al. 1985:122).

While these various improvements were being made, the Southwest Pass remained closed to commercial shipping. According to a report to the Chief of Engineers in 1911:

> On the whole it may be said that the progress made in improving this channel is very satisfactory. Although the channel is not yet open to navigation, a large steamer drawing 30 ft went to sea through this channel April 18, 1911. This was the deepest draft vessel that ever sailed from the port of New Orleans (Chief of Engineers 1911:1736).

Emphasizing that commercial navigation would interfere with the continuing dredging operations, the report recommended that "Southwest Pass should not be used, except in special cases, until further channel development is secured" (Chief of Engineers 1911:1736). The recommendation was not adopted, however; the Southwest Pass channel officially opened to commercial navigation on December 26, 1911. When subsidence of the original jetties presented problems in 1913, capping stone was placed on the outer portions of the jetties and concrete on the inner portions. This effort prevented water from escaping over the jetties except at extraordinary high water (Chief of Engineers 1914:2566).

Petroleum and petroleum-related products constituted the largest volume of both imports and exports. Other leading imports included bananas, sugar, molasses, syrup, and coffee. Wheat, raw cotton, and a significant amount of lumber also were shipped through the ports (Goodwin et al. 1985:106).

From 1920, the channel at Southwest Pass was maintained at a depth of thirty-five ft, which required frequent dredging and repair to the jetties. In 1921, in an innovative engineering design, the entrance channel at Southwest Pass was inclined eastward at an angle of 36° from the jetty channels; after this re-design, the requirement for maintenance dredging was reduced. According to one authority, the maintenance of a dependable channel dates from this significant change of 1921 (Scheffaver 1954:329). Subsequent technological improvements increased the speed and efficiency of the dredge boats that operated in the Southwest Pass.

In the summer of 1941, on the eve of American entry into the Second World War, construction began on a Navy Section Base in the lower portion of the Burrwood Reservation. The military installation was intended to engage in anti-submarine warfare. From the time that the war actually began until 1943, German submarines posed a significant threat to commercial shipping from the Mississippi River. A German submarine sank the oil tanker *Virginia* in the Southwest Pass early in 1942 (Morison 1961:140-141). On the same day, the Germans fired at a destroyer but missed their target; instead, the torpedo hit the jetties near the lighthouse on Southwest Pass (Goodwin et al. 1985:115).

At the conclusion of the war, the Burrwood facility declined in importance and

eventually was closed. A fueling station and machine shop no longer were needed at the mouth of the river. The hopper dredge *Benyaurd,* which had devoted its entire operational life (1904 – 1946) to maintaining the Southwest Pass, also was retired. After the *Benyaurd*'s withdrawal, the *Langfitt* alone operated as a dredgeboat at the mouth of the river. In 1949, this vessel was equipped with radar, which enabled it to operate more easily in adverse weather conditions.

Louisiana began to develop its offshore oil and gas fields during the late 1940s. Since that time, numerous oil production facilities and pipelines have been established along the banks of the Southwest Pass. Oil and gas submarine pipelines run beside and across the pass.

In 1945, the United States Congress combined several navigational projects into the "Mississippi River, Baton Rouge to the Gulf of Mexico" project, which included the Southwest and South passes. This legislation deepened the Southwest Pass to 40 by 800 ft and the Southwest Pass Bar Channel to 40 by 600 ft. Further legislation concerning the project in 1962 deepened the channel between Baton Rouge and New Orleans to 40 ft (Secretary of the Army 1996:11-13). By 1963, the 40 ft channel was completed for a distance of 30 mi, from just below the town of Venice through the Southwest Pass to the Gulf of Mexico. From 1964 to 1980, annual maintenance dredging for this 30 mi stretch produced an average 20 million cubic yards of spoil per year. Unfortunately, subsidence and erosion within this reach led to loss of river banks and to river widening in several areas. While this loss of river water benefited the surrounding marshes, it caused increased shoaling within the navigational channel (Carney 1984:EIS44).

A 1984 environmental impact study conducted by the Corps of Engineers emphasized that "[T]he maintenance of Southwest Pass is becoming a more complex problem ... as a result of the rapid deterioration of the banks of the river and pass" (Carney 1984:EIS6). The deterioration resulted largely from subsidence, but wave erosion generated by storms and ship traffic also contributed to the problem.

The following year, Congress authorized the deepening of the channel through the Southwest Pass to a project depth of 55 ft. However, the legislation also contained a cost-sharing clause that required that "[F]or channels deeper than 45 ft, the cost sharing requirements are 50 per cent Federal and 50 per cent non-Federal for both construction and maintenance (Secretary of the Army 1996:11-14,15). The imposition of this cost-sharing requirement dampened state and local enthusiasm for deepening the channel considerably.

The process of subsidence, including sea level rise, continues to affect coastal Louisiana and to convert uplands and wetlands to open water. The subsidence of the banks of the pass and the loss of river water over its banks has resulted in increased shoaling within the Southwest Pass. As shoaling increases, it constrains river traffic and increases the costs of maintaining the channel. The Corps of Engineers therefore hopes to restore the subsided banks in order to increase river-water velocities, which decrease shoaling and thus improve navigation.

Navigation through the Southwest Pass remains a vital objective. The Mississippi River continues to serve as the mainstream of the world's most highly developed waterway system. As a result, the Corps of Engineers finds itself under considerable economic and political pressure to insure that the Southwest Pass remains open and usable. In the more than three centuries since La Salle discovered the mouth of the Mississippi, the passes have presented some daunting problems and called forth some dazzling engineering feats.

Maritime Context

The twentieth century was marked by greatly improved ground transportation systems, including rail and auto, which substantially decreased the need to transport goods by vessel. At the same time, there was an increase in the regional or local use of intercoastal waters.

The greatest changes in maritime technology during this period centered on the increased use of engine power after 1916, and the use of steel-hulled vessels. Engine power replaced the power of sails, a process which

was completed by 1975 (Wilson 1983). Modern types of water transport came to dominate the waters. They were barges, harbor boats, steamers, and fishing vessels. With the demise of sea borne Gulf coast trade, an increase in the regional or local use of intercoastal waters developed for purposes that were both economic and recreational.

The commerce of war gave way to a return to peace time maritime activities that employed large vessels to these Gulf ports to carry goods in large quantities at lower transport costs. For reasons of economy, "deep water" became an issue for the competing ports of the coastal states that wanted channels deepened so that large vessels could sail through shallow waters. Dredging changed the character of sea routes leading to ports: passes were modified, new ones cut, and old ones allowed to fill as natural harbors and channels were altered to accommodate post-World War II demands of maritime commerce and technology. These sea route modifications have meant a greater occurrence of historic shipwrecks in waters further from the Gulf shore. The larger vessels required by the growing ports became more restricted to specific entrance channels and less natural navigable water was open to them along the shallow coast. Ships that strayed too far from open fairways or dredged channels often were wrecked.

Shipping lanes for out-of-the-Gulf commerce, were based on connections between 15 major Gulf ports dealing in foreign trade during the first half of this twentieth Century period. After leaving port ships would sail for one of two points, the Yucatan channel or an area south of the Dry Tortugas. From there they would head either eastward into the Atlantic or southwest toward the Panama Canal. Shipping routes for in-Gulf commerce remained the same as those developed in the period of 1820 to 1899 (Coastal Environments, Inc. 1977).

CHAPTER IV

RESEARCH METHODS

Archival Investigations

Archival research concerning the history of the Southwest Pass ODMDS project area focused primarily on determining: land use adjacent to the survey block and its relationship to waterborne transportation on this section of the Mississippi River; the history of the area as an ocean dredged material disposal site; and, specific vessel losses reported near or within the project area. To accomplish this task, the archives at a number of institutions and collections were consulted: Tulane University's Howard Tilton Library; the New Orleans Public Library, Louisiana Division; the Williams Research Center, Historic New Orleans Collection, New Orleans; the U.S. Army Corps of Engineers Library, New Orleans District; and the State of Louisiana's Department of Culture, Recreation, and Tourism, Division of Archeology. Shipwreck data were obtained through a number of sources including the State of Louisiana Shipwreck Database (Department of Culture, Recreation, and Tourism, Division of Archeology), the U.S. Army Corps of Engineers shipwreck data base (USCE Planning Division, New Orleans District), and the Automated Wreck and Obstruction Information System (AWOIS) of the National Oceanic and Atmospheric Administration (NOAA). In addition, U.S. Coastal and Geodetic Service nautical charts, Omega Version Bottom Contour Chart, historic maps, U.S. Army Corps of Engineers reports, vessel directories and archeological reports of previous investigations within the vicinity of the Southwest Pass project area sited in this report were researched at the Library of Congress in Washington, D.C. and at the National Archives in Washington D.C. and at College Park, Maryland. Individual histories of recorded shipwrecks were researched at the National Oceanic and Atmospheric Administration, Silver Spring, Maryland.

Additional shipwreck data were obtained from published secondary sources, specifically Berman's *Encyclopedia of American Shipwrecks*, *Way's Packet Directory*, and Lytle and Holdcamper's *Merchant Steam Vessels of the United States, 1790-1868*. The following books with lists of shipwrecks also were examined:

Beneath the Waters: A Guide to Civil War Shipwrecks (Hemphill 1998);
A Guide to Sunken Ships in American Waters (Lonsdale and Kaplan 1964);
Way's Steam Towboat Directory (Way, Jr. 1990);
Wreck List Information (Hydrographic Office, U.S. Navy 1945).

Archeological Investigations

The Southwest Pass ODMDS marine remote sensing survey was conducted from the 24 ft research vessel R/V *Coli*. R/V *Coli* was leased from the Louisiana Universities Marine Consortium (LUMCON), and was captained by LUMCON's Mr. Samuel LeBouef. The project area consisted of a continuous survey block which, was divided into 68 parallel track lines spaced at 100 ft intervals. A total of 253.0 linear miles (407.4 km) were surveyed. The survey block measured 6,652.8 ft (2,027.3 m) x 19,377.6 ft (5,906.4 m) for a total of 2,959.5 acres and was formed by the following coordinates:

NW corner - $28^0$54.20' N x $89^0$27.25' W
NE corner - $28^0$54.20' N X $89^0$26.00' W
SW corner - $28^0$51.00' N X $89^0$27.25' W
SE corner – $28^0$51.00' N X $89^0$26.00' W

The remote sensing survey was designed to identify specific magnetic or acoustic anomalies and/or clusters of anomalies that might represent potentially significant submerged cultural resources, such as shipwrecks. The natural and anthropogenic forces that form such sites typically scatter ferrous objects like fasteners, anchors, engine parts, ballast, weaponry, cargo, tools, and miscellaneous related debris across the river bottom. These objects normally can be detected with a marine magnetometer, side scan sonar system, and fathometer that record anomalous magnetic or acoustic underwater signatures that stand out against the ambient magnetic or visual field. Two critical elements in the interpretation of such anomalies, which may also result from natural or modern sources, are their patterns and, in the case of magnetic anomalies, their amplitude and duration. Because of the importance of anomaly patterning, accurate recording and positioning of anomaly locations is essential.

The equipment array used for the Southwest Pass ODMDS survey included a DGPS, a proton precession marine magnetometer, a side scan sonar, and a fathometer (Figure 14). Data were collected and correlated via a laptop computer using hydrographic survey software.

Positioning

A Differential Global Positioning System (DGPS) was used to direct navigation and supply accurate positions of magnetic and acoustic anomalies. The DGPS system consisted of a Northstar 941XD with internal DGPS. The Northstar 941XD transmitted position information in NMEA 0183 code to the computer navigation system (version 7.0 of Coastal Oceanographics' *Hypack* software).

Hypack translates the NMEA message and displays the survey vessel's position on a computer screen relative to the pre-plotted track lines. During post-processing, *Hypack's* positioning files can be utilized to produce track plot maps and to derive the X, Y, and Z values used to produce magnetic and bathymetric contour plot maps. For the Southwest Pass ODMDS marine remote sensing survey, positioning control points were obtained continuously by *Hypack* at one-second intervals. During the course of the survey, strong differential signals were acquired with a minimum noise to signal ratio.

Magnetometry

The recording proton precession marine magnetometer is an electronic instrument used to record the strength of the earth's magnetic field in increments of nanoTeslas or gammas. Magnetometers have proven useful in marine research as detectors of anomalous distortions in the earth's ambient magnetic field, particularly distortions that are caused by concentrations of naturally occurring and manmade, ferrous materials. Distortions or changes as small as 0.5 gammas are detectable when operating the magnetometer at a sampling rate of one second. Magnetic distortions caused by shipwrecks may range in intensity from several gammas to several thousand gammas, depending upon such factors as the mass of ferrous materials present, the distance of the ferrous mass from the sensor, and the orientation of the mass relative to the sensor (Figure 15). The uses of magnetometers in marine archeology and the theoretical aspects of the physical principals behind their operation are summarized and discussed in detail in Aitken (1961), Hall (1966, 1970), Tite (1972), Breiner (1973), Weymouth (1986), and Green (1990).

Individual anomalies produce distinctive magnetic "signatures." These individual signatures may be categorized as 1) positive monopole; 2) negative monopole; 3) dipolar or 4)-multi component (Figure 16). Positive and negative anomalies refer to monopolar deflections of the magnetic field and usually indicate a single source. They produce either a positive or negative deflection from the ambient magnetic field, depending on how the object is oriented relative to the magnetometer sensor and whether its positive or negative

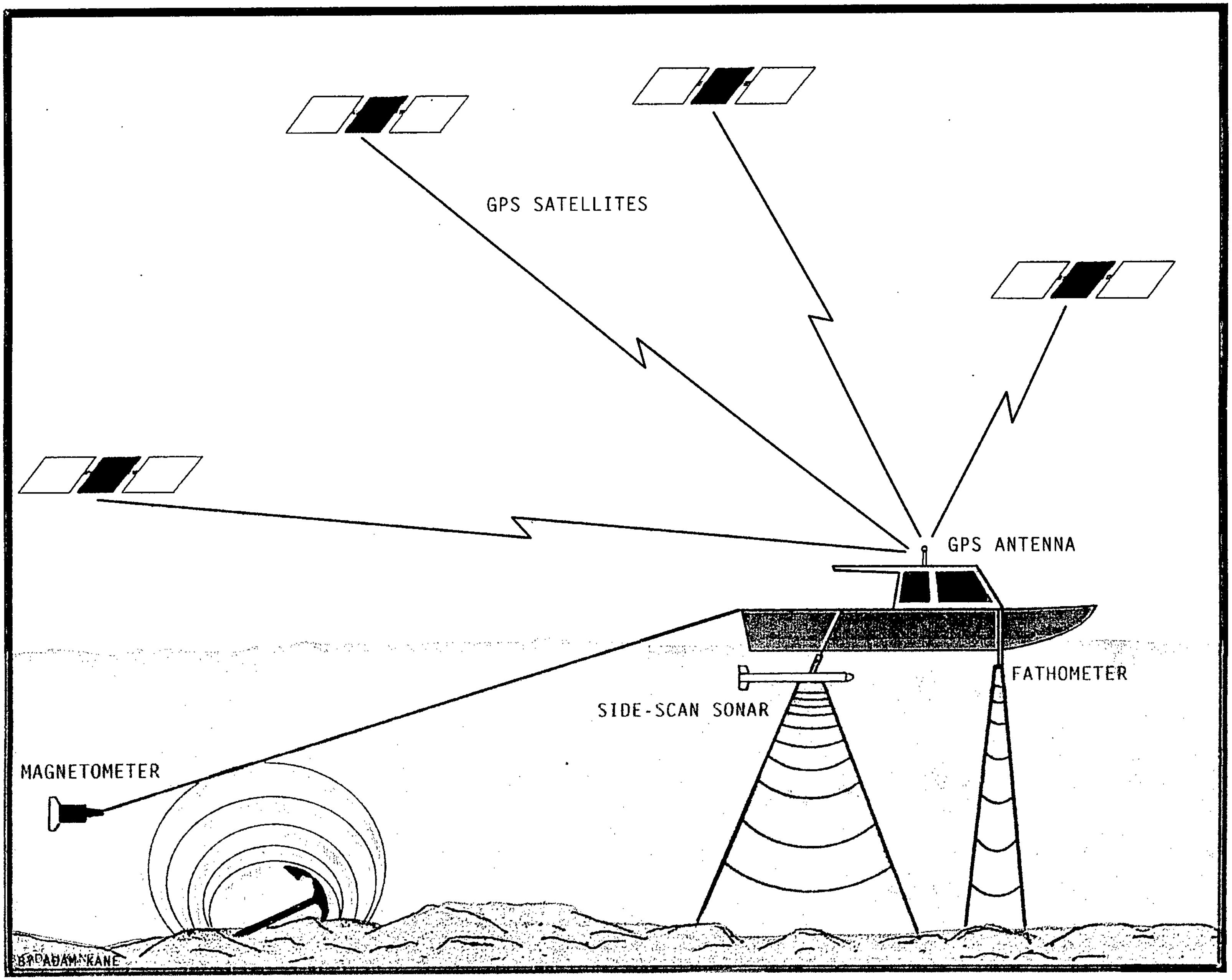

Figure 14. Array of instruments used during the Southwest Pass survey

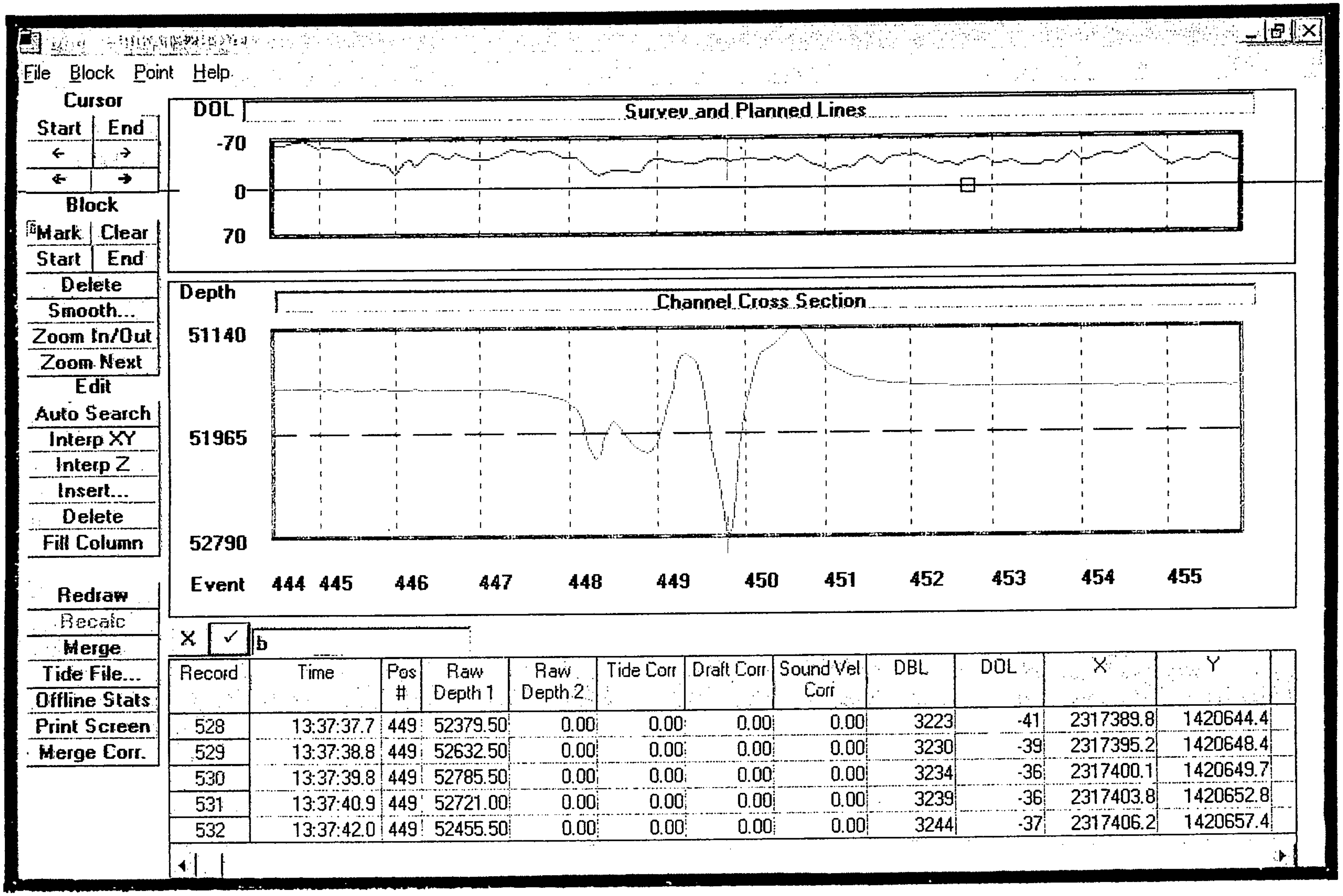

Figure 15. *Hypack* "Edit" screen image of a 1,650 gamma magnetic anomaly caused by the hull remains of a ca. 1860 steamboat wreck discovered by RCG&A during a recently completed remote sensing survey of the upper Yazoo River near Greenwood, Mississippi.

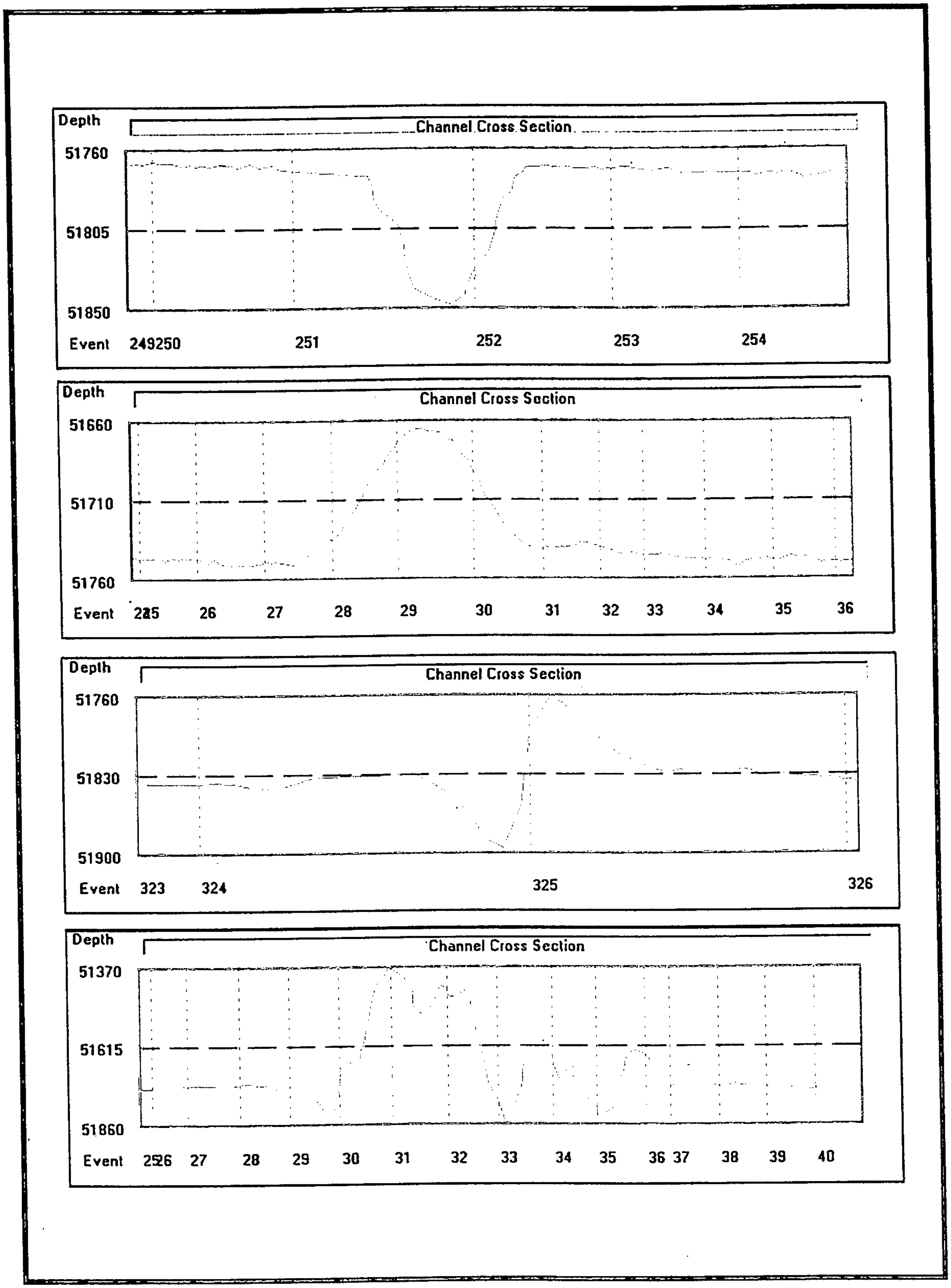

Figure 16. *Hypack* magnetic data screen showing the four types of magnetic signals commonly seen during a magnetic survey

pole is positioned closest to the sensor. Dipolar signatures display both a rise and a fall above and below the ambient field; they also are commonly associated with single source anomalies, with the dipole usually aligned along the axis of the magnetic field and the negative peak of the anomaly falling nearest the North Pole.

Especially important for archeological surveys are multi-component anomalies. Multi-component or complex signature anomalies consist of both dipolar and monopolar magnetic perturbations associated with a large overall deflection that can be indicative of the multiple individual ferrous materials comprising the debris patterns typically associated with shipwrecks. The complexity of the signature is affected partially by the distance of the sensor from the debris and the quantity of debris. If the sensor is close to the wreck, the signature will be multi component; if far away, it may appear as a single source signature.

A Geometrics G866 proton precession marine magnetometer was used to complete the magnetic survey of the Southwest Pass ODMDS project area. The G866 is a 0.1 gamma sensitivity magnetometer that downloads magnetic data in digital format as numeric data files in *Hypack*. As the magnetic data are being collected, *Hypack* attaches the precise real-time DGPS coordinates to each magnetic reading, thus ensuring precise positioning control. The magnetometer was towed far enough behind the survey vessel to minimize the associated noise, which generally measured less than two gammas. A float was attached to the magnetometer sensor, so that a consistent depth below the water's surface could be maintained.

Acoustic Imaging

Over the past 25 years, the combined use of acoustic (sonar) and magnetic remote sensing equipment has proven to be the most effective method of identifying submerged cultural resources and assessing their potential for further research (Hall 1970; Green 1990). When combined with magnetic data, the near photographic-quality acoustic records produced by side scan sonar systems have left little doubt regarding the identifications of some targets that are intact shipwrecks (Figure 17). For targets lacking structural integrity or those partially buried beneath bottom sediments, identification can be extremely difficult. Because intact and exposed wrecks are less common than broken and buried wrecks, remote sensing surveys generally produce acoustic targets that require ground-truthing by divers to determine their identification and historic significance.

An Imagenex color imaging digital side scan sonar system was utilized continuously during the Southwest Pass ODMDS survey to produce sonograms of the river bottom on each transect within the project area. The Imagenex system consisted of a Model 858 processor coupled with a Model 855 dual transducer tow fish operating at a frequency of 330 KHz. The sonar was set at a range of 90 ft per channel, which yielded overlapping coverage of the study areas. Sonar data were recorded in a digital format on a 270 megabyte 3.5 in SyQuest cartridge. A stream of time-tags was attached continuously to the sonar data to assist in post-processing correlation of the acoustic and magnetic data sets. Acoustic images were displayed on a VGA monitor as they were recorded during the survey, and an observation log was maintained by the sonar technician to record descriptions of the anomalies and the times and locations associated with each target. Potential targets were inventoried both during the survey and in post-processing.

The methodology employed during the survey produced favorable results, with reliable DGPS signals, low noise levels on the magnetometer, and clear acoustic images. All positioning and remote sensing equipment performed reliably throughout the survey. Regular and evenly spaced coverage of the entire survey area was achieved.

Survey Control and Correlation of Data Sets

The *Hypack* survey software provided the primary method of control during the survey. Survey lanes were planned in *Hypack*, geodetic parameters were

established, and instruments were interfaced and recorded through the computer software. During the survey, the planned survey lines were displayed on the computer screen, and the survey vessel's track was monitored. In addition to providing steering direction for the helmsman, *Hypack* allowed the surveyors to monitor instruments and incoming data through additional windows on the survey screen.

All remote sensing data were correlated with DGPS positioning data and time through *Hypack*. Positions for all data then were corrected through the software for instrument layback and offsets. Positioning was recorded using Louisiana South State Plane grid coordinates, referencing the North American Datum of 1983 (NAD-83). The GRS-1980 ellipsoid was used, along with a Lambert projection.

Remote Sensing Data Analysis

Magnetic and acoustic data were analyzed in the field while they were generated, and post-processed using *Hypack* and Autodesk's *AutoCAD* computer software applications. These computer programs were used to assess the signature, intensity, and duration of individual magnetic disturbances, and to plot their positions within the project area.

In the analysis of magnetometer data for this survey, individual anomalies were identified and carefully examined. First, the profile of each anomaly was characterized in terms of pattern, amplitude, and duration. Magnetic data were correlated with field notes, so that deflections from modern sources, such as channel markers, could be identified. Although all anomalies with an amplitude greater than ten gammas were given a magnetic anomaly number for reference purposes and tabulate; anomalies of larger amplitude (more than 50 gammas) and of longer duration (more than 20 seconds) generally are considered to have a higher likelihood of representing possible shipwreck remains, especially when such anomalies cluster together.

Side scan sonar data were examined for anomalous acoustic targets and shadows that might represent potentially significant submerged cultural resources, and to correlate with any magnetic or bathymetric anomalies.

Figure 17. Imagenex 858 side scan sonar image of shipwreck located by RCG&A in 1998 on the Calcasieu River, Calcasieu Parish, Louisiana

CHAPTER V

PREVIOUS INVESTIGATIONS

Introduction

The present chapter provides background contextual information about previous archeological and architectural investigations completed within the general vicinity of the project area. This information was sought in order to ensure that any previously recorded cultural resources situated within the current study area were relocated during fieldwork. The chapter is divided into three sections. The first contains a review of previous cultural resources surveys completed within 6.4 km (4 mi) of the proposed project item. The second section presents a review of previously recorded archeological sites located within 6.4 km (4 mi) of this study area. Finally, a description of previously recorded standing structures located within 6.4 km (4 mi) of the project parcel is presented. The information contained in this review was based on a background search of data currently on file at the Louisiana Department of Culture, Recreation and Tourism, Office of Cultural Development, Divisions of Archaeology and Historic Preservation, in Baton Rouge.

Previously Conducted Cultural Resources Surveys Located within 6.4 km (4 mi) of the Currently Proposed Project Area

A total of two previously completed cultural resources surveys and archeological inventories have been conducted within 6.4 km (4 mi) of the currently proposed project area (Table 1). These investigations resulted in the identification of 272 magnetic anomalies; however, no archeological sites were noted. Both previously conducted surveys were completed in portions of Plaquemines Parish, and they are presented here in chronological order.

During 1983, archeologists and technical personnel from the U.S. Army Corps of Engineers, New Orleans District, completed a cultural resources survey of 48.3 km (30 mi) within the Balize Lobe section of the Mississippi River (Muller 1985). As a component of the Deep Draft Channel Deepening Project, this research was designed to identify any potentially significant submerged properties (watercraft, docks, structures, etc.) through the acquisition of remote sensing data. Field survey, employing both side-scan sonar and proton magnetometry, resulted in the identification of 144 anomalies; however, only 33 of these signatures were assessed as potentially significant cultural resources. At these potentially significant locations, additional testing (archival research or diver verification) or avoidance (modification of construction plans) was recommended.

R. Christopher Goodwin & Associates, Inc. of New Orleans, Louisiana conducted a Phase I marine archeological remote sensing survey during June of 1999 of three segments (Blocks One, Two, and Three) situated along the Southwest Pass of the Mississippi River in Plaquemines Parish, Louisiana (Goodwin et al. 2000). The survey was completed on behalf of the U.S. Army Corps of Engineers, New Orleans District prior to proposed repair and maintenance activities. Goodwin et al. (2000) noted that Block One was located between River Mile 14.4 and River Mile 15.2, while Block Two was situated between River

Mile 11.3 and River Mile 12.5. The final survey area (Block Three) extended from River Mile 4.4 to River Mile 5.0. In total, 206 ha (509 ac) were subjected to marine archeological remote sensing survey. Side scan sonar survey augmented by magnetometer survey of the three proposed project areas resulted in the identification of 128 magnetic anomalies and four acoustic disturbances.

Goodwin et al. (2000) reported that all 128 anomalies exhibited magnetic characteristics associated with modern ferrous debris, and that none of the targets displayed attributes typically associated with shipwrecks or other potentially significant submerged cultural resources. In addition, all four of the noted acoustic disturbances were attributed to modern structures or debris, including a remnant dock, a fuel dock, a water tank, and a pipeline. Goodwin et al. (2000) assessed the 128 magnetic anomalies and the four acoustic disturbances as not significant; no additional testing of the three proposed project areas was recommended.

Previously Recorded Archeological Sites Located within 6.4 km (4 mi) of the Currently Proposed Project Area

A review of the previously recorded archeological sites on file at the Louisiana Department of Culture, Recreation and Tourism, Office of Cultural Development, Division of Archaeology in Baton Rouge, failed to identify any previously recorded archeological sites situated within 6.4 km (4 mi) of the currently proposed project area.

Previously Recorded Standing Structures Located within 6.4 km (4 mi) of the Currently Proposed Project Area

A review of the standing structure files located at the Louisiana Department of Culture, Recreation and Tourism, Office of Cultural Development, Division of Historic Preservation, Baton Rouge, failed to identify any previously recorded standing structures located within 6.4 km (4 mi) of the currently proposed project area.

CHAPTER VI

ARCHIVAL RESULTS

The Mississippi River System

The Mississippi River system has its roots in the upper Mississippi Valley where it was formed about 10,000 years ago from glaciers that deposited layers of sediment. By the time the glaciers finally melted, tremendous quantities of water were released that cut channels through the sedimental debris. Today's upper Mississippi, and its tributaries, follow these ancient channels. As the meltwater flowed south, it was joined by the Ohio and Missouri rivers which produced the great channel of the lower Mississippi. Today the Mississippi River is defined as beginning at Minnesota's Lake Itasca, flowing south through the central United States, and spilling out into the Gulf of Mexico through the Mississippi Delta.

The Mississippi forms the eastern border of most of Minnesota, Iowa, Missouri, and Arkansas and much of Louisiana; and the western border of most of Wisconsin, Illinois, Kentucky, Tennessee, and Mississippi. Along its course the river is joined by many tributaries, most notably the Illinois River, which connects north of Alton, Illinois; the Missouri River, which connects north of St. Louis, Missouri; the Ohio River, which connects at Cairo, Illinois; and the Arkansas River, which connects north of Arkansas City, Arkansas. (Figure 18)

At Lake Itasca, Minnesota, the Mississippi River is about 12 ft wide and 1.5 ft deep. But it is impossible to navigate the river north of Saint Paul, Minnesota, because of the 65 ft cascade located at the Falls of Saint Anthony. From Saint Paul to where it joins the Missouri River, the Mississippi is between 1,000 to 2,000 ft wide. This section of the river contains 29 dams and locks that provide a navigation channel 9 ft deep.

Two rivers, the Missouri and the Ohio, have a major impact in determining the characteristics of the Mississippi. The Missouri River contributes large volume of water into the Mississippi. Due to volume of water and its accompanying sediment, the channel is muddy and swift along the 200 mi stretch between St. Louis and Cairo.

At the juncture with the Ohio River, the Mississippi receives nearly half of its flow. From Cairo, Illinois to New Orleans, Louisiana the river varies in width from 3,000 to 5,000 ft and meanders through a floodplain that is 40 to 70 mi wide. This section contains a navigation channel 9 to 12 ft deep. In its lower course, the river separates into two branches about 200 mi before it reaches the Gulf of Mexico. The first branch, the Old River Diversion, sends about one-quarter of the Mississippi's flow to the gulf via the Atchafalaya River; it contains a system of dams, locks, and levees. The remainder of the river's flow continues past Baton Rouge and New Orleans and then branches out through the river's delta into the Gulf by means of small channels, known as distributaries.

Navigability of the Southwest Pass

A major distributary of river flow in the Mississippi Delta is Southwest Pass. The direction of Southwest Pass is nearly southwest. It reaches the open Gulf at a distance of about 17 mi from the Head of the Passes (HOP), or 105 mi below New Orleans. The width of the pass varies from half a mile to nearly one mile. Passing through the mouth of Southwest Pass always has been a

major impediment to shipping through the Southwest Pass, between New Orleans and the Gulf (US Congress 1858:30-31). In 1839, the pass flowed over tidal bars which were divided by intermediate bars into two or three outlets. The depths of these outlets restricted navigability for a distance of about 1.5 mi across the tidal bar to craft of approximately 10 to 18 ft draught. Even at that, vessels sailing through the pass usually dragged their keels through soft mud. Figure 19 is a map of soundings recorded at Southwest Pass in 1838. It displays the complex obstacle course ships faced as they maneuvered through the mouth of the Pass.

The earliest cartographic depictions of the Mississippi Delta generally are graphically crude and only barely allude to the complexity of the river system of deltaic distributaries as depicted in such early maps as the *Carte de la Côte de la Louisiane* (1719-1720; refers to Southwest Pass as Passe à Serigny) (Figure 20) and by Clarkson (post-1736) (Figure 21). Soundings, and their reminder of the dangers represented to shipping by shallow channels leading up to and through the Southwest Pass, are only sporadically given for the Gulf waters surrounding the Delta in the early maps. Nor are any kinds of obstructions depicted, natural or cultural. By 1820, a map by the Hydrographic Office of the U.S. Army Corps of Engineers begins to list soundings through the Southwest Pass channel itself all the way past the (HOP) (Figure 22).

The tidal bars throughout the area of the mouth of Southwest Pass create continuous hazards to shipping. They are composed of alluvium that usually occur at points where fresh river water meets the salt water of the sea, "and extends entirely around the protruding delta formations that constitute the grounds over and through which the river pours its waters into the Gulf by its numerous outlets. The bar at first is composed of recent alluvion, in a semi-liquid sate, and consisting of particles exceedingly comminuted and unctuous. Figure 23 records the shifting nature of the Pass at its mouth and depicts profiles of one bar surveyed in 1838 and then in 1874. In time, and by the agency of the Gulf billows, it becomes more or less solidified and indurated, and resolves itself into beds and bars, imposing serious impediments in the way of navigation" (US Congress 1858:31). Figure 24 lists an unidentified wreck recorded in 1874 south-southwest of Stake Island.

Another natural obstacle dangerous to shipping were numerous mud lumps found outside the tidal bar area. In the 1850s, the natural process causing mud lumps was not understood. But it was realized that portions of the bar were acted upon by upheaving forces from beneath causing various forms to be created, mostly conical. They rose in height to several ft above their bases, some as high as 12 ft. They were noticed to occur at the bottom and sides of the channels across the bar and to emit sea water and inflammable gas. Once risen to a certain height, some lumps remained there permanently, while others shrank back to the bottom after a few weeks (US Congress 1858:31-32).

The shallow water at the mouths of the Mississippi River are the result of increased settlements throughout the alluvial region tributary to the Mississippi River. The once rich forests and undergrowth of the region have been widely cleared leaving loose soil easily carried away during annual floods. Vast amounts of alluvium are deposited in the Gulf of Mexico forming shoals, banks, bars, and islands (US Congress 1837:3).

Economic Importance of the Mississippi River System

Many cities and towns along the Mississippi depend on the river for their continued economic survival. To make the river navigable, dredging, and the building of locks and levees along the Mississippi have eliminated numerous hazards to commercial navigation. This has made it possible for large vessels to sail up the river to its northern limit of navigability at Saint Paul/Minneapolis in Minnesota.

The Mississippi River and its tributaries constitute the central core of a vast commercial and transportation network. Along the Mississippi Valley and

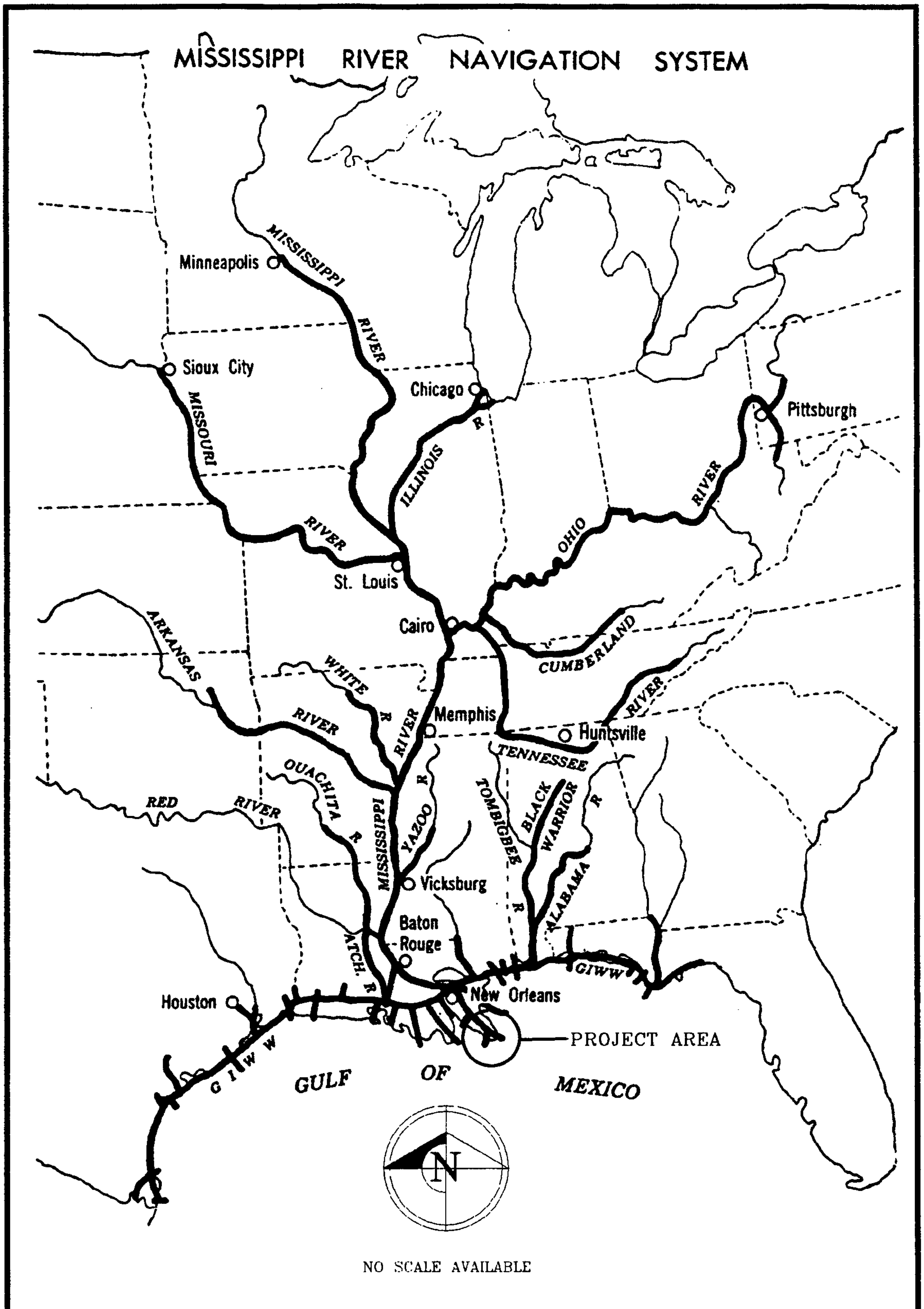

Figure 18. Map of *Mississippi River Navigation System* showing Southwest Pass in 1838 (Cowdrey 1971).

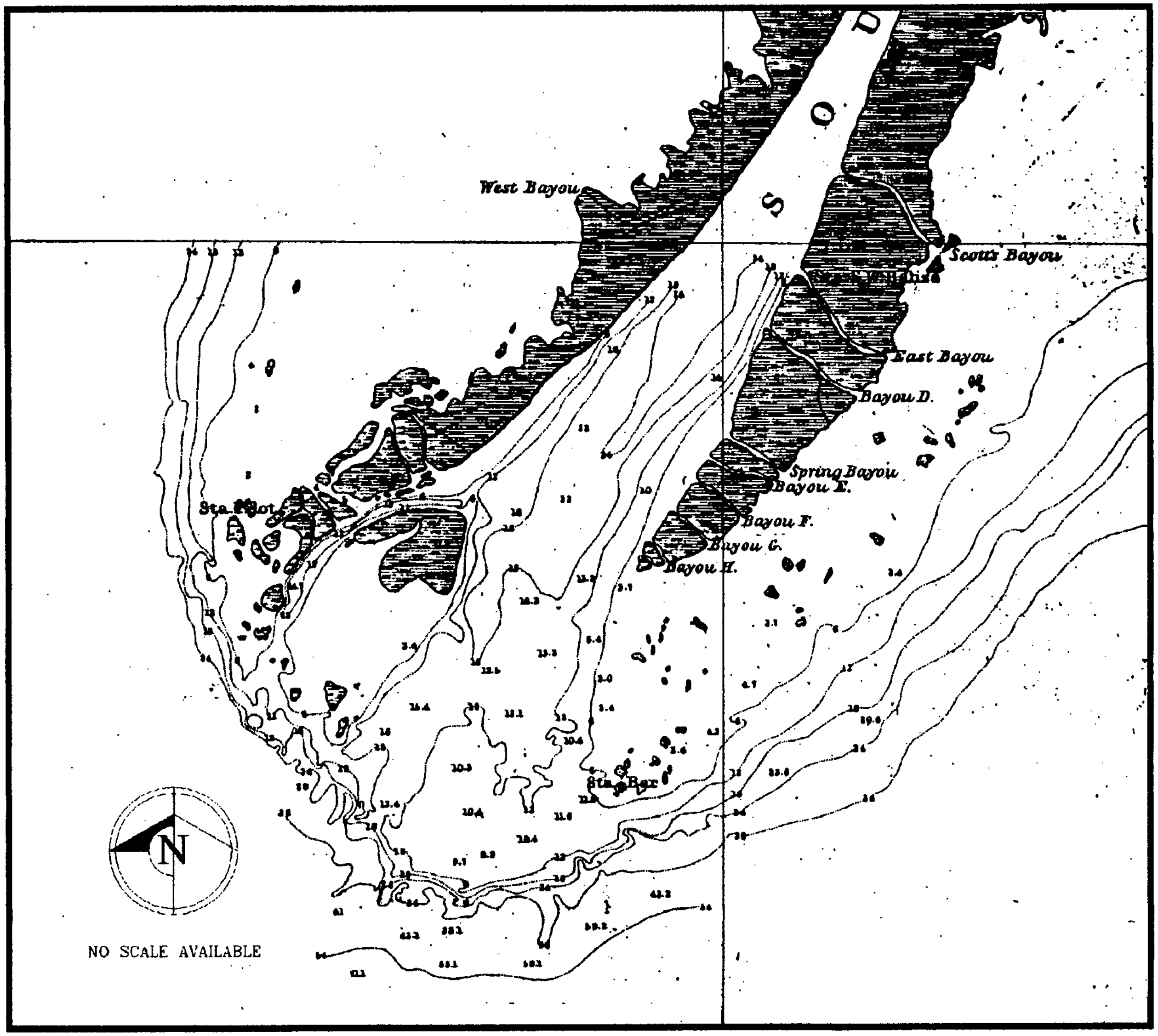

Figure 19. Excerpt from 1839 U.S. Army Corps of Engineers map *Delta of the Mississippi.*

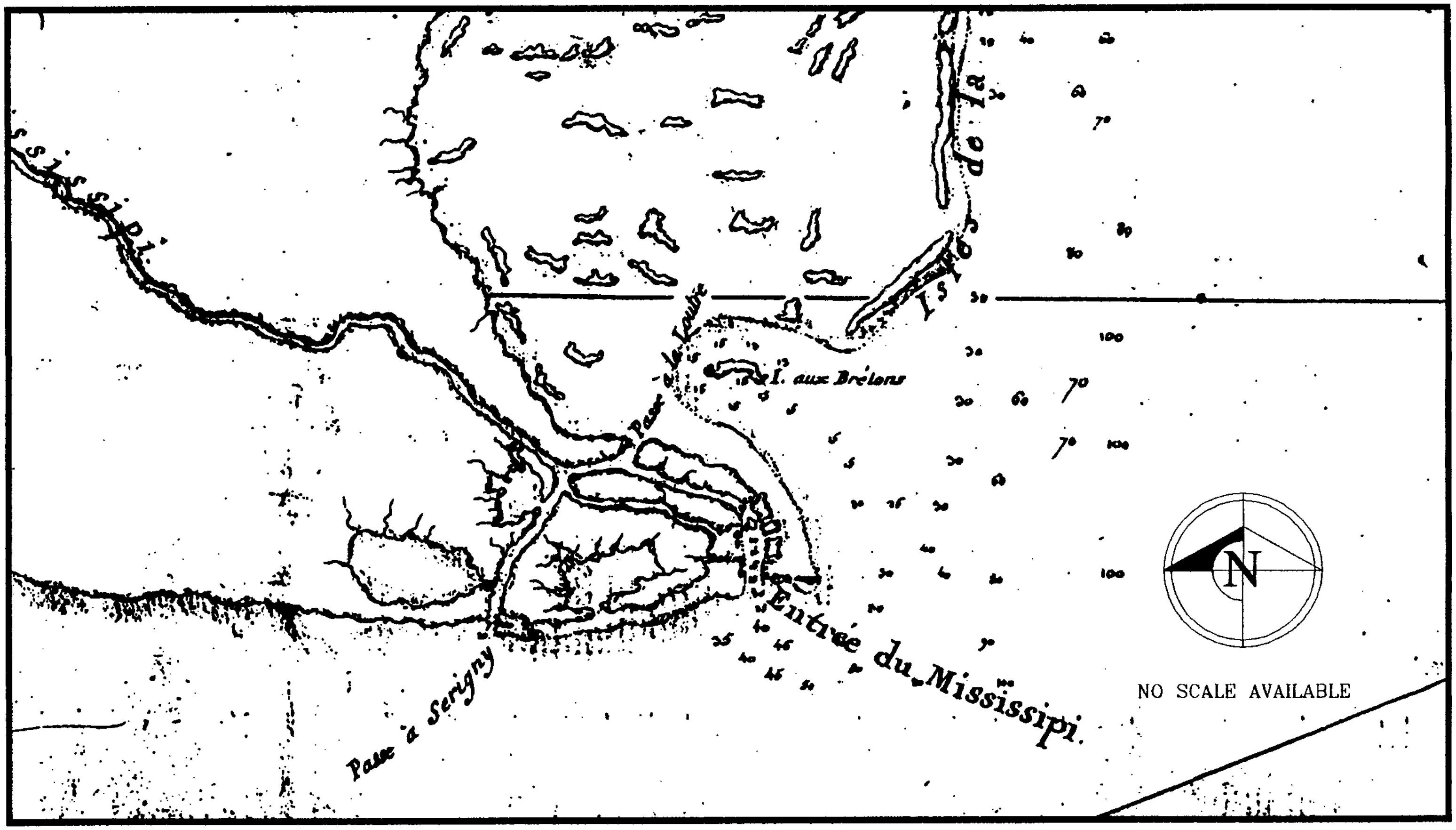

Figure 20. Excerpt from map *Carte de la Côte de la Louisiane* (1719-1720).

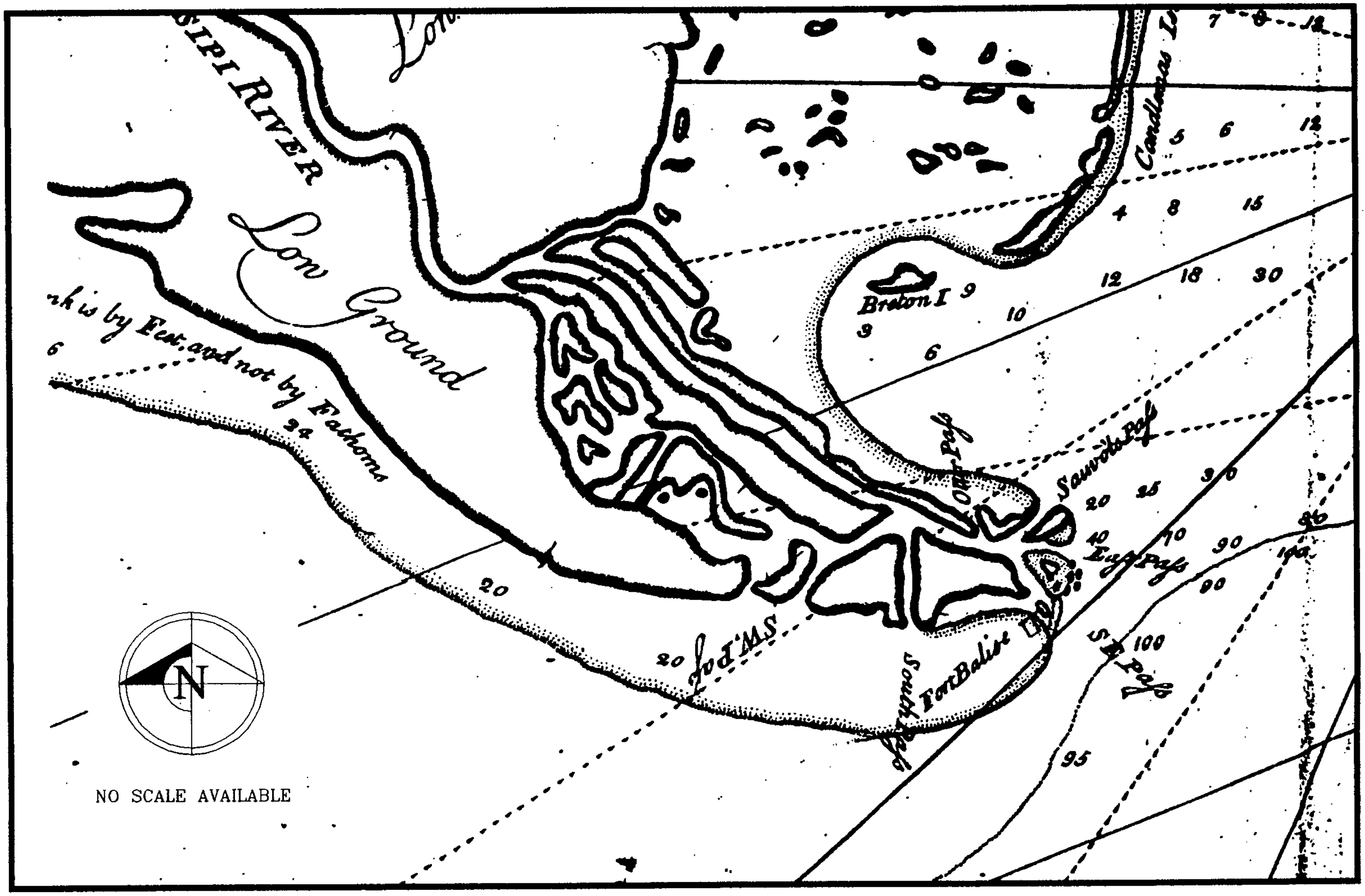

Figure 21. Excerpt from Clarkson (undated) map *A General Chart of All the Coast of the Province of Louisiana.*

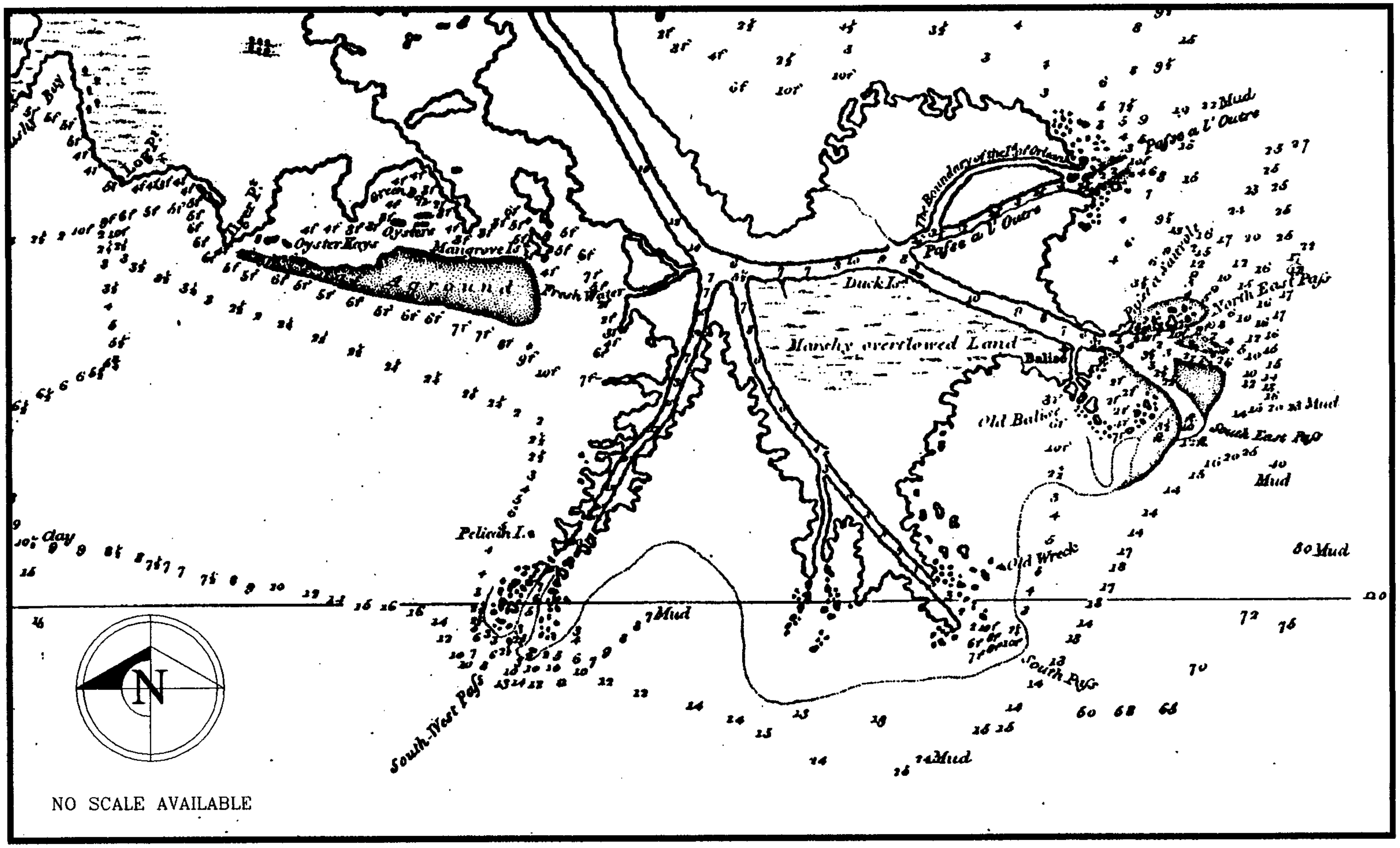

Figure 22. Excerpt from 1820(?) map of the Mississippi Delta passes and early recording of water depths within and around Southwest Pass.

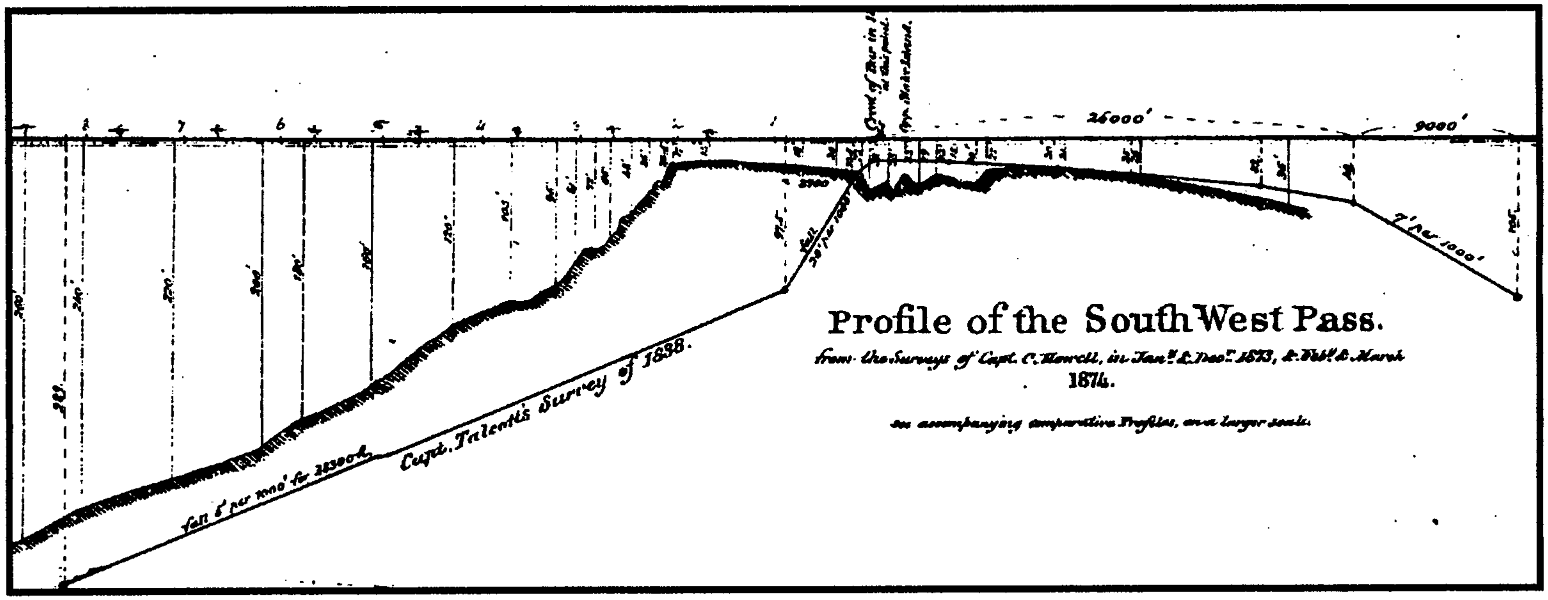

Figure 23. Detail, "Profile of the South West Pass," from Capt. Talcott's 1838 and Capt. Howell's 1873 surveys in map *Delta of the Mississippi River* (1874).

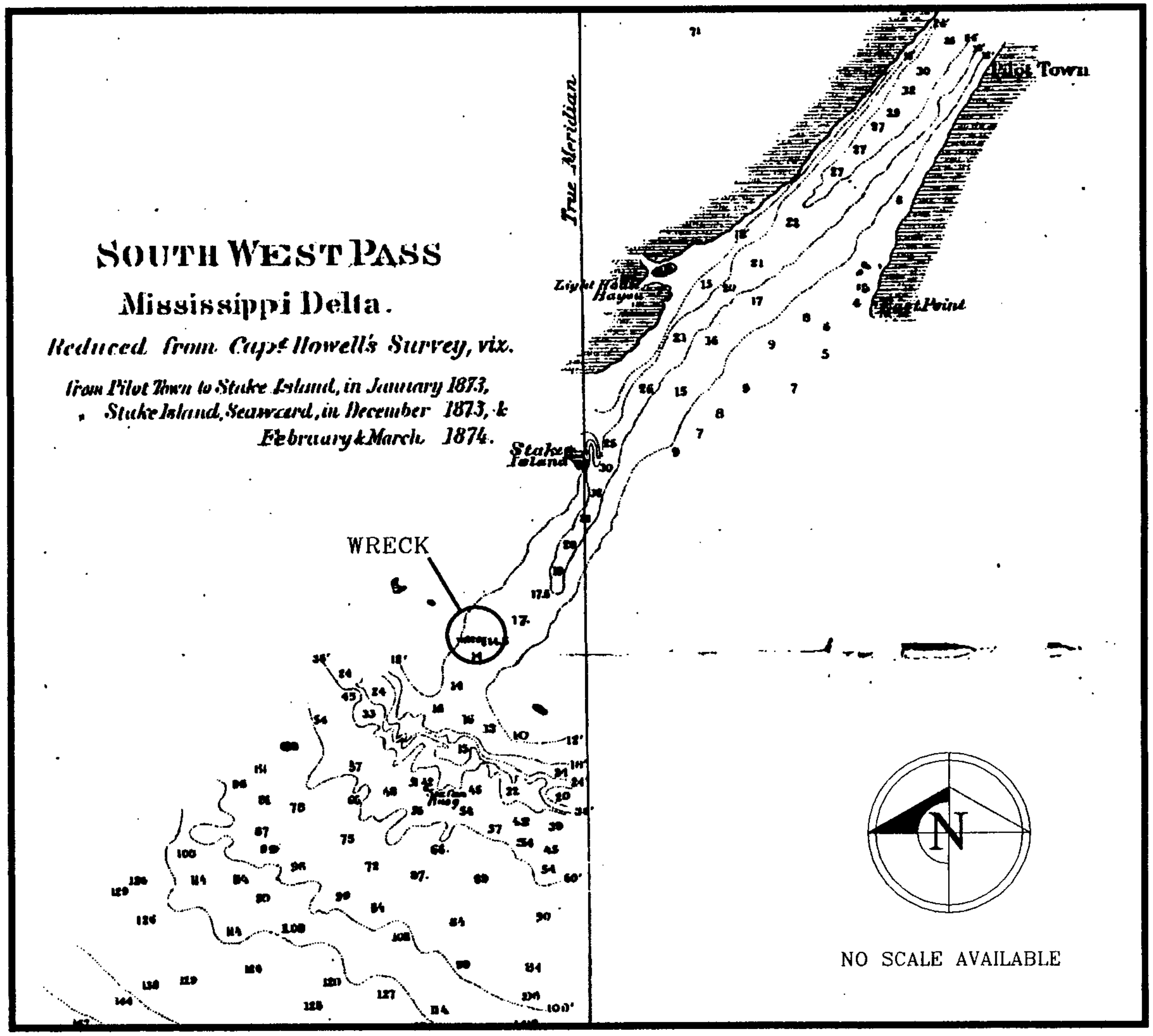

Figure 24. Map *South West Pass, Mississippi Delta*, reduced from Capt. Howell's Survey (1873-1874), showing a wreck at the moth of Southwest Pass. (Humphreys 1876).

its system of rivers with their floodplains containing rich alluvial soils, industries developed producing, accumulating, and shipping agricultural commodities. In the north, Saint Paul became a grain-shipping port, exporting wheat and feed grains such as soybeans. In the south, cotton, groundnuts, and rice were shipped through the Mississippi. St. Louis, near the junction of the Missouri became a port linking the Mississippi and the Great Plains. Because the portion of the river south of Baton Rouge is deep enough to be navigable by oceangoing vessels, Baton Rouge and New Orleans became major seaports. Each year about 282 million metric tons of freight are carried on the Mississippi River. The most important cargoes on the river are bulk items such as coal, petroleum products, sand, gravel, and grain.

The economy of New Orleans has traditionally been dominated by shipping, including both river barge and ocean vessel traffic. Extensive dock facilities are located along the Mississippi River, the Gulf Intracoastal Waterway, and the Mississippi-Gulf Outlet (a deep channel opened in 1963). Exports from the city's vast hinterland include grains, cotton, and food and petroleum products. Imports, many of which come from Latin America, include bananas, cocoa, coffee, and bauxite. The city's industrial base is highly diversified and encompasses more than 800 manufacturing operations. The leading industries include shipbuilding, petroleum refining, food processing, and the manufacture of clothing, construction materials, wood products, primary metals, and petrochemicals.

Export/Import Commodities at the Port of New Orleans

As the major customs district in the Gulf, New Orleans traded in the wider economy of the northern Gulf of Mexico. The Port of New Orleans received regional commodities produced from around the Gulf and redistributed it for regional consumption or export. Major domestic ports of origin were either on the Gulf (Pensacola, New Orleans) or the East Coast (New York, Philadelphia). Foreign ports of origin were in Latin America, the Caribbean, Western Europe, and, occasionally, Asia (Goodwin et al. 1999).

An examination of records at the New Orleans Customs District of types of commodities traded at the port provide historical indexes of changing trade goods, imported and exported through time, that reflect the growth of settlements in the lower South and changes in manufacturing technology. New Orleans is the leading indicator of principal commodity types shipped to and from the Gulf. The history of the evolution of a market economy from an agricultural base to a processing and manufacturing based economy in the South is recorded in the cargo types shipped through the port of New Orleans. During the late 1800s, food items, construction products, coal to fuel industries, and fertilizer for agriculture were big trade items. In the early 1900s, a growing industrial market required engines, petroleum, oil products, and chemicals. The need for food items, raw materials, and building materials increased as the economy continued to industrialize. The materials handled at the Port of New Orleans were typical of markets along the northern Gulf of Mexico. They were exchanged between markets found in the interior of the United States and markets in Latin America, Europe, and Asia (Goodwin et al. 1999).

In 1914, the principal commodity types handled in New Orleans were: coffee, sugar, sisal, burlap, bananas, and kainit and fertilizers; while principal exports were: cotton, wheat, tobacco, lumber staves, cotton seed, meal, and cake (Davis 1915; Baughn 1950). Table 2 summarizes principal import and export commodity types handled at the Port of New Orleans.

During the early 1800s, cotton materials made up major portions of ships' manifests and were destined in large part for the growing number of settlers coming to the South after the Creek Indian War in 1814; 1813 and 1814 marked the introduction of the power loom and with it the mass production of cotton fabrics (Oliver 1956). Iron, steel, and other imported construction products listed in the customs invoices were likely

meant for the growing frontier of Alabama and Mississippi.

Many statistical indices demonstrated the importance of the Pass to the continued commercial success of the lower Mississippi River. In 1910, traffic through the passes amounted to not quite four million tons, but when the Southwest Pass opened the tonnage increased to five million by 1912, six million by 1913, seven million by 1916, eight million by 1917, nine million by 1918, 11 million by 1920, 12 million by 1921, 13 million by 1923, and 15 million by 1924 (Chief of Engineers 1925:675). A 1914 Report to the Chief of Engineers attributed the lower freight rates at the port of New Orleans to safer and improved conditions on the Southwest Pass (Chief of Engineers 1914:725).

During the interlude between the First and Second World Wars, the channel through the Southwest Pass was maintained at a 35 ft depth. Traffic through the passes peaked in 1926 at almost 19 million tons. The subsequent decline in tonnage had more to do with the severe and long-lasting economic depression that began in 1929 than to any defects in the Southwest Pass (Chief of Engineers 1936:1178).

Characteristics of Shipping Routes, Ship Types, and Shipwrecks in the Gulf of Mexico

The early economies of colonial territories along the Gulf of Mexico originally were based on the extraction of minerals, the production of raw materials, and early agriculture. The evolution of these territorial economies started in the 1500s, when the Spaniards controlled the coastal regions of the Gulf of Mexico. Their main concern was the export of precious goods such as gold and spices. The kinds of produce and materials shipped from Gulf coast ports and the types of ships used to transport goods evolved as the territories slowly developed from pre-industrial agrarian societies to ones based on high technology, manufactured goods, and tourism.

Shipping routes and ports act as nodes along trade routes. As occupation of coastal areas increased along the Gulf rim, so did coastal traffic; trade networks became more complex, and a hierarchy of trade centers developed as a consequence. The port sites largely were a function of the size of port facilities and the navigability of specific harbors (geographic factors). Thus, the ultimate determining factor for the location of a port is its position relative to specific economic goods such as natural resources, manufactured items, and services (Garrison et al. 1989:32).

Shipping routes developed in the Gulf in similar fashion, also in relation to the goods that were sought and produced and the markets they were taken to. Figures 25-29 show the progression of shipping routes within the Gulf from 1763 to the present day. From 1763 to 1821 shipping routes in the Gulf were dominated by the Spanish, French, and British trade routes. Important centers of export were in Mexico, the Mississippi Sound area (from the Mississippi River to Pensacola), and Cuba. By 1862, other ports opened up between Mexico and the Mississippi River. As trade and industry grew, and as ship technology changed to take on an increased load capacity, routes to the outside of the Gulf continued south between Yucatan and Cuba or through the Bahama Straits towards America's east coast or on to Europe.

No exact information is available for shipwrecks during the 1500s, 1600s, and 1700s for the Gulf of Mexico. The compiling of shipwreck data that included dates and positions only began in the early 1800s.

Generally, shipwreck losses in the Gulf, occurred because of politics, weather, and trade. They show the following historic trends from 1500 to 1999 (Garrison et al. 1989):

> 1500-1549: losses are random and reflect Spanish activities associated with exploration of the Gulf coast and exploitation of Gulf coast interior resources
>
> 1550-1599: losses become patterned and are associated with

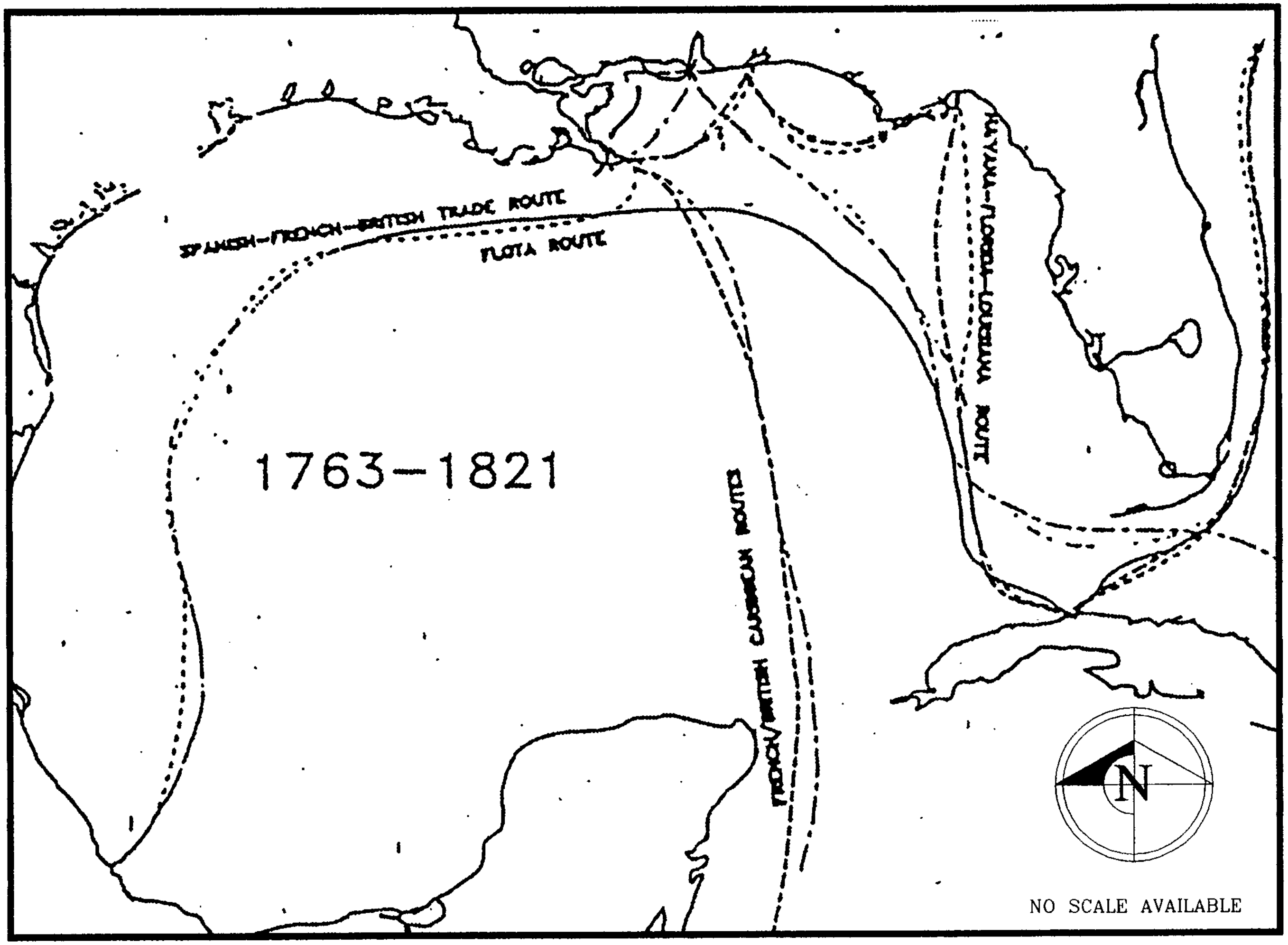

Figure 25. Map of shipping routes within the Gulf of Mexico and points outside, 1763-1821 (Garrison *et al.* 1989).

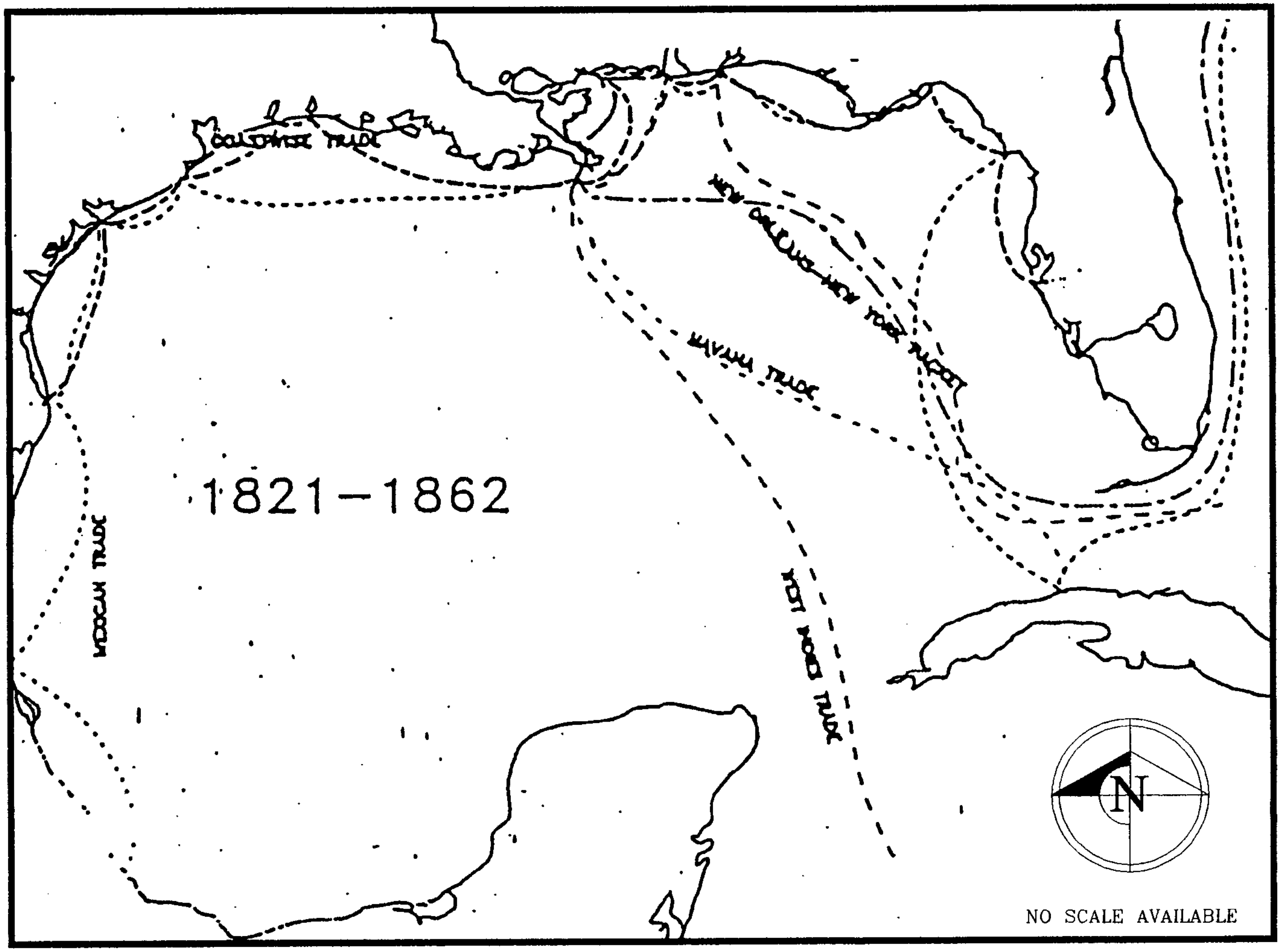

Figure 26. Map of shipping routes within the Gulf of Mexico and points outside, 1821-1862 (Garrison *et al.* 1989).

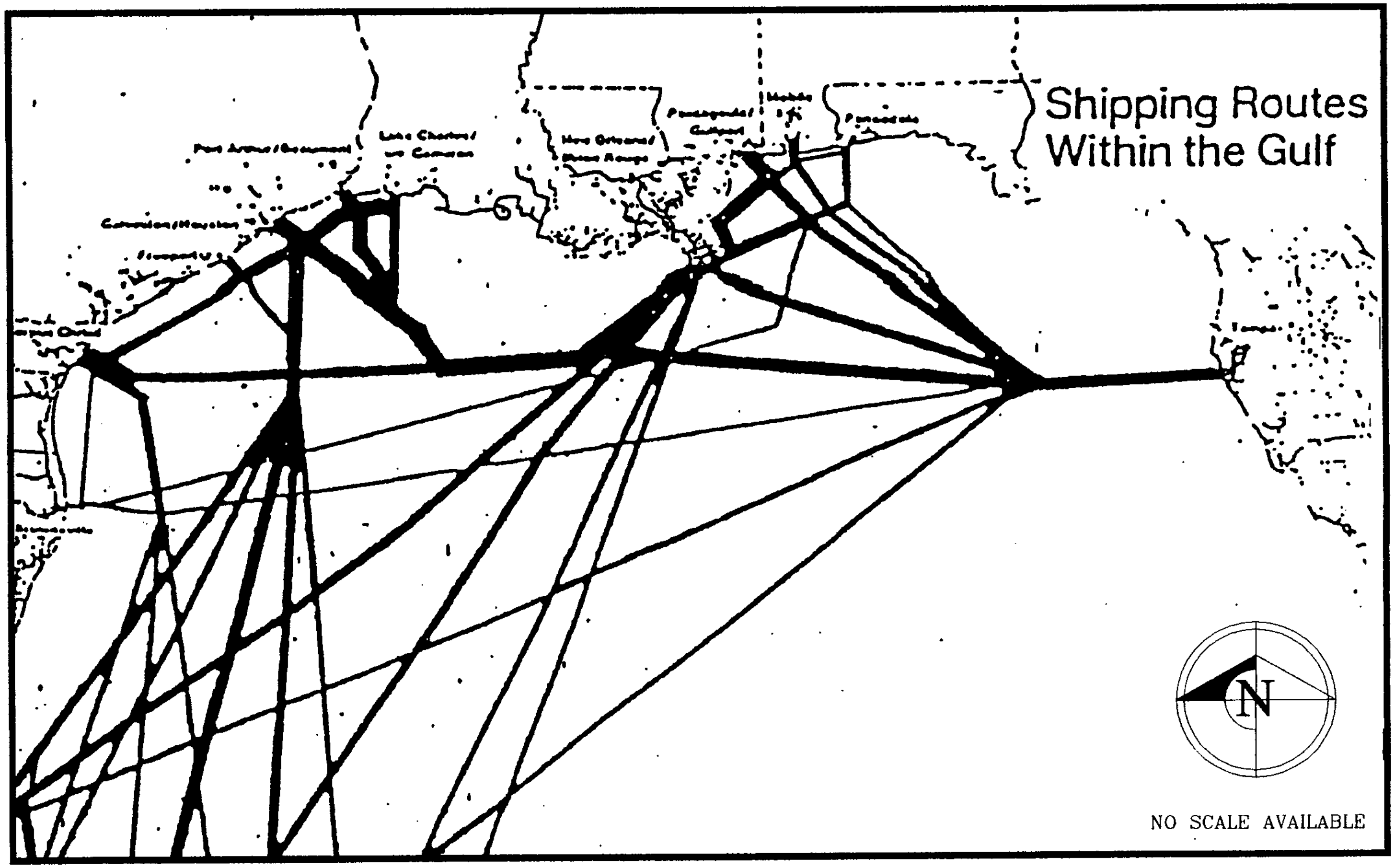

Figure 27. Map of present day shipping routes within the Gulf of Mèxico (Garrison *et al.* 1989).

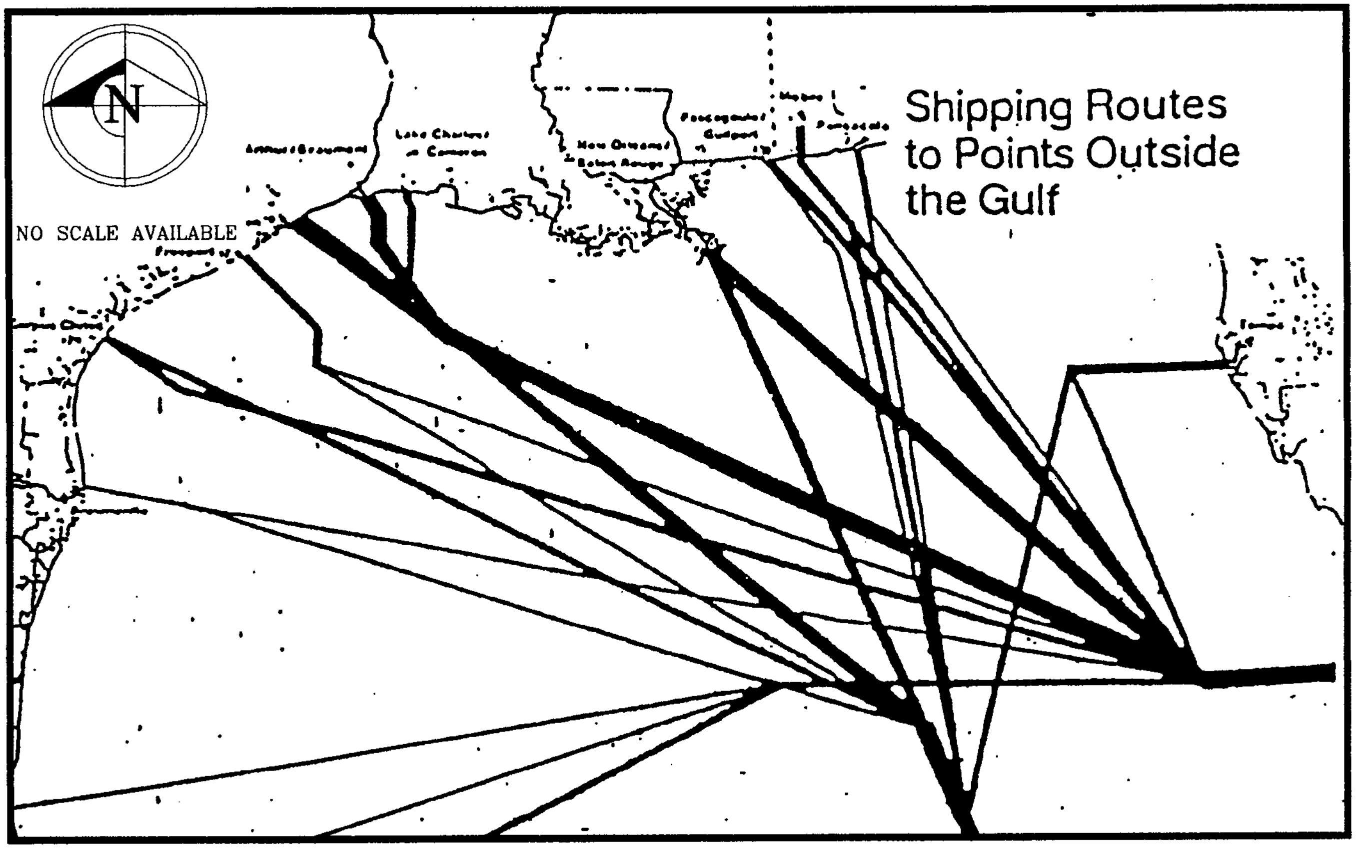

Figure 28. Map of present day shipping routes to points outside of the Gulf of Mexico (Garrison *et al.* 1989).

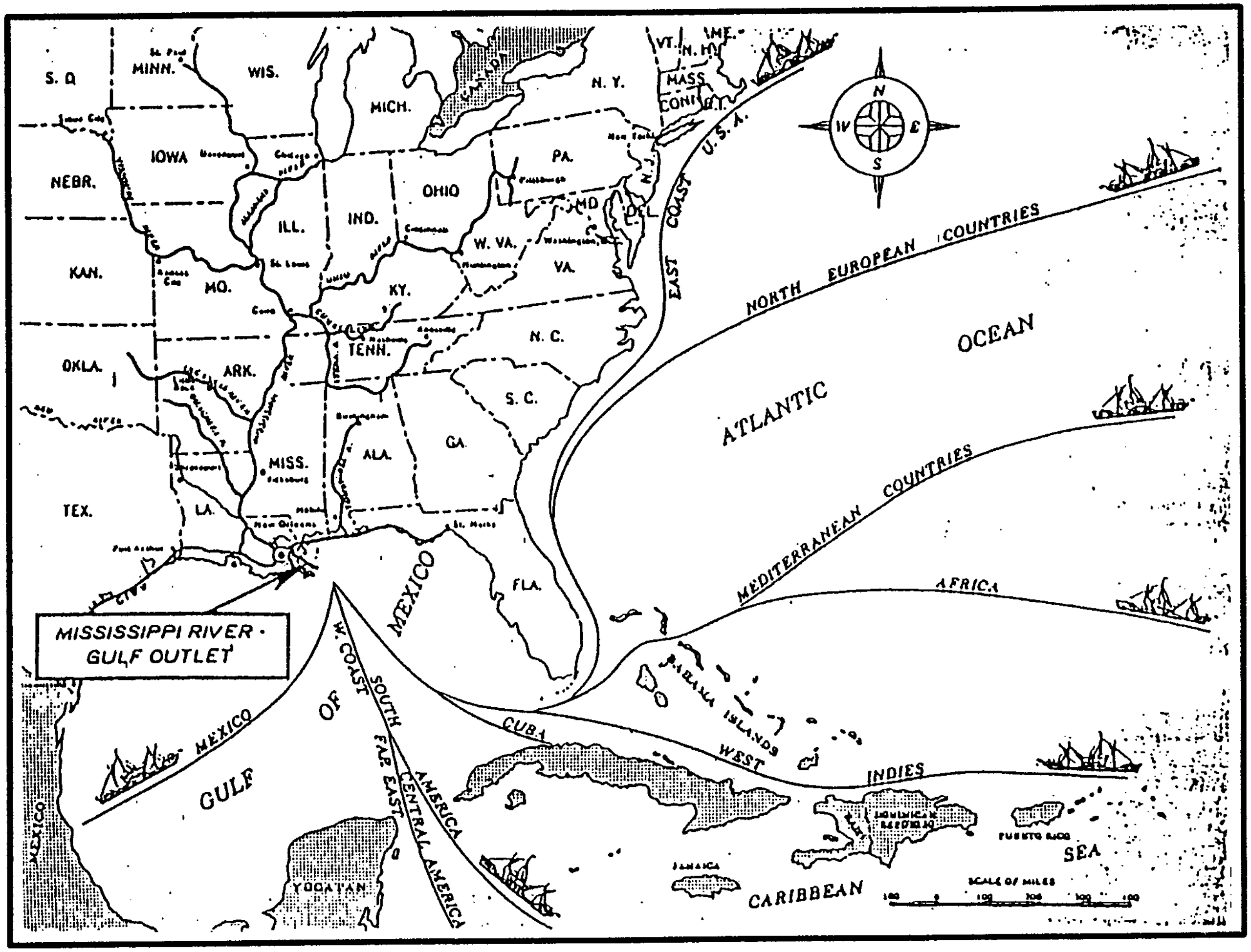

Figure 29. Map of present day shipping routes to points south and east of the Gulf of Mexico (Garrison *et al.* 1989).

flota routes and weather factors, especially along the Texas and Florida coasts

1600-1649: losses remain Spanish vessels, in particular losses due to the 1622 hurricane

1650-1699: losses mostly to Spanish ships, but the first French ships are lost at the Gulf of Matagorda Bay in 1685

1700-1749: the first major change in ship loss patterns occur during this period and reflect French colonization of Louisiana and Spanish movements into Pensacola to counter the French

1750-1799: ship losses reflect the apex of Spanish and French colonization and commercial movements in the northern Gulf

1800-1849: shipwreck losses still remain associated with colonization and its extension in the Gulf area; port development occurs west of the Mississippi delta in Louisiana and Texas and shipwreck patterns show a westward movement

1850-1899: a westward movement of shipwrecks continues but is offset by the development of ports east of the Mississippi delta as principal ports evolve there in New Orleans, Mobile, and the North-central Gulf; the area becomes a major egress channel for inter-Gulf commerce

1900-1919: the inter-Gulf pattern of shipping and commerce is magnified by intra-Gulf trade, the development of fisheries off of Florida, the growing port of Tampa, and the rise of the Mississippi River and New Orleans as major nodes for commercial sea routes

1919-1939: a fully modern era of shipping develops reflecting commerce in commodity goods, such as oil and agriculture

1940-1959: Florida fisheries and trade through the port of Tampa are two important factors contributing to shipwrecks in the eastern Gulf; petroleum production causes intra-Gulf shipping routes to shift towards Houston

1960-1999: all shipping routes, for both inter- and intra-Gulf trade, remain east-west reflecting bulk cargo movement from central and north-west ports on the Gulf of Mexico; losses are associated with exploration and production of petroleum in the north-west area of the outer shelf

Major Commercial Vessels, 1800s to the Present

During the 1800s, two main types of vessels carried goods to and from ports along the Gulf. They were the schooner and the steamer. In the 1900s, the predominant ship types gradually changed from the schooner and the steamer, both of which were used into the 1920s, to gas and oil-powered vessels (screw-driven), yachts, and fishing vessels, which appeared in the 1960s. Other sunken vessel types included tugs, barges, dredges, and a pile drivers. Table 3 shows a complete listing of ship types that sailed in the Gulf of Mexico from 1500 to the 1980s.

During the eighteenth and nineteenth centuries, schooners were developed in the United States to utilize on and offshore winds (Howard 1979). Two principal classes of cargo schooner were developed: a smaller version with fuller lines, and sharper lined, taller-rigged vessels used at times by smugglers and privateers (Faye 1940). In later centuries, the schooner also developed into the classic fore-and-aft rigged ship with

up to six masts. The schooner design continued to dominate coastal traffic in nineteenth century and continued in use well into the twentieth century (Nevins 1946:5; *Sea Technology* 1986). Schooners remained in fishing fleets up to 1933, when law changes permitted oyster dredging with motor vessels (Mistovich et al. 1983).

Sloops encompassed three kinds of vessels in the eighteenth century: the single-masted sloop, the 5-masted sloop (variants being called scows, brigs and ketches), and the 3-masted ship sloop. Sloops had no midden mast and ketches had no foremast. Many sloops had an unbroken sheer of their main deck (Howard 1979) and were square-rigged.

While the schooners continued in use in the Gulf up to World War II, steamers continued until the 1920s. They appeared in a number of different versions. The sidewheel paddle was used in rivers. This vessel design had a shallow draft with a light hull and usually was driven by a high pressure steam engine or engines turning two side paddles. Sidewheelers were common in the mid-late nineteenth century coastal trade.

Sternwheel steamers eventually supplanted sidewheelers on rivers. They were less effective on the Gulf, where the sternwheel often was lifted out of the water because of wave action. The popularity of the sternwheel design lay in its narrower breadth which meant easier use on bayous, canals, and the coast.

Other steam vessel types, such as the paddle and screw propeller, were developed in the mid-to-late-nineteenth century. The paddle had a deep draft keel and balanced rudders. Early versions were all wooden, but iron and steel hulls supplanted wood by the turn of the century. Some of the mid-late nineteenth century vessels maintained a sail rig either fore-and-aft, or schooner style. The screw propeller had a deep draft, and a keeled hull with a propeller. It supplanted paddle designs by the late nineteenth century due to its greater propulsion efficiency. Screw propellers were the classic cargo ship design after 1914, with a steel hull separated by watertight bulkheads, a deckhouse amidships and masts rigged as booms for unloading. Their common size was 16,000 dead weight tons with lengths of up to lengths of 350 ft.

The German Submarine, or U-boat, operated in the Gulf of Mexico and was a ship type to be reckoned with from 1942-1944. The U-Boats were responsible for sinkings of Allied ships along the northern coast of the Gulf. The tanker vessel constituted the principal target of German submarines in the Gulf of Mexico during World War II (Röhwer 1983).

Military Action--The Civil War

The degree or complexity of maritime defensive works by the Confederates throughout Southwest Pass is uncertain. Yet a few ships were wrecked due to Confederate obstructions aimed at stopping Union forces from coming up the Mississippi River. Perhaps the most intricate system of defenses was employed to the east of Southwest Pass at the Battle of Mobile Bay in 1864. It was one of the most important naval encounters in American history and was marked by attendant defensive maritime works constructed by the Confederates. The Confederate naval obstructions, if used anywhere in Southwest Pass, would have been similar to the types and technology used elsewhere by Confederate forces in the northern Gulf region (see Table 4 for types of Confederate obstructions used against Union naval forces at Mobile Bay).

Mobile's importance as a supply depot for the South during the Civil War prompted Confederate engineers to build shipping obstructions to keep Union ships from entering Mobile Bay to attack the city from the sea, and to maintain open shipping lanes to the outside world in order to resupply the Confederate States.

Various kinds of sea-side obstructions were employed. The upper line of defense was made up of log piles, while the lower line consisted mainly of sunken ships held together with heavy cables and held in place by pilings. The ship had to be loaded sufficiently with heavy materials to keep it sunken and keep it from moving. Ships were sunken filled with brick, brickbats, sand, burnt

clay, and stone. Pig iron also was used (Von Sheliha 1868).

The other major obstruction used by Confederate engineers were piles; these were preferred over all other kinds of obstructions. Piles were driven closely together (perhaps a hundred or more) in rows. Braces connected the priers to each other. Long, heavy logs floated between the rows, making up booms which were attached to the piers of logs with heavy chains. In most cases, the piles were constructed of yellow pine, bark left on, with a diameter of from twelve to fifteen inches, and with a length dependant on the depth of the water (Von Sheliha 1868). Other obstructions included floating mines (called torpedoes), and heavy batteries constructed to guard the torpedoes. These techniques proved relatively successful in keeping Union vessels from navigable waters and forcing them into shoals and shallows.

World War II

The German submarine operated in the Gulf of Mexico from 1942-1944. The tanker vessel was their main target in the Gulf of Mexico during World War II (Röhwer 1983). The research for this report identified Allied shipping sunk by U-Boats. Nautical chart No. 1007-A, prepared by the Navy Department in 1943, lists two wrecks (Nos. 490, and 479) in the waters surrounding Southwest Pass. (Figure 30) Immediately to the west of the project corridor, the *Virginia* (No. 490) was sunk in 1942. The other vessel, the *Bayard* (No. 479), located to the northeast of the mouth of Pass a l'Outre, was a passenger freighter of Norwegian origin. It also was sunk in 1942.

Shipwrecks in the Vicinity of the Project Area

The dangerous situation at Southwest Pass for navigation through the alluvial tidal bars, mud lumps and shoals surrounding the mouth of the pass is emphasized by the list of vessels in Table 5. These are examples of the great number of maritime accidents that occurred during the short period from 1892 to 1898.

Review of available documentation at several diverse repositories, including the Automated Wreck and Obstruction Information System (AWOIS) of the National Oceanographic and Atmospheric Administration (NOAA), and the National Image and Mapping Agency by the U.S. Navy, indicated that a total of 25 vessels had been reported as lost near or within the vicinity of the Southwest Pass project area. Six obstructions also were reported (Table 6). Of the 25 vessels, eight were barges. Most appear to have foundered or were lost in storms in the 1960s, except for one that went down in 1912. The earliest ship types to be wrecked in the vicinity of the project area were two steam side-wheel vessels. Both exploded, the *Grampus* at the mouth of the river in 1840, and the *Tiger* at Southwest Pass in 1844. Two clipper ships were reported to have gone down at the mouth of the Mississippi River, the *Harry of the West* in 1865, and the *Governor Morton* in 1877. Three fishing vessels were lost, two (the *Bonus Kin* and the *Captain R.J. Sanders*) in 1967 and one (the *Espisisa)* in 1973. Screw type vessels are recorded wrecked in the Pass from 1922 to 1966: two gas screw vessels (the *Nola* in 1922 and the *Kiva* in 1939) went down in the Gulf side of the pass; four oil screw vessels (the *Victoria* in 1927, the *Compadre* in 1953, the *Buccaneer* in 1965, and the *Malcolm B. Toomer* in 1966) were lost on both side of the pass; and three steam screw ships were lost, the *Yuma* in 1926, and two steam screw tankers (the *Virginia* and the *Halo*) sunk by German submarines in 1942. Six other obstructions are recorded also. Four are unidentified types of obstructions, but one is listed as submerged piling and the other as buoy sinkers and chain.

Within the northwest corner of the project area, three sites have been recorded by the U.S. Navy for the National Image and Mapping Agency. They are items No. 32,767, No. 32,112, and No. 32,615 (see Figure 25 for a map of AWOIS and Navy recorded wreck sites). Site Nos. 32,112 and 32,767 are barges reported lost in 1965 and 1968 respectively in the vicinity of an oil platform. Another barge, site No. 32,615, is also a barge lost in 1967 to the south of Nos. 32,112 and 32,767.

The most important vessel wreck in the vicinity of the project corridor is that of the *Virginia*. Listed as AWOIS No. 290 and by the Navy as No. 36,000, the *Virginia* is located immediately along the western edge of the project area (Figure 31). It was a steel steam screw tanker that was sunk on May 12, 1942, by a German submarine. Twenty-seven lives were lost. The wreck lies 150 yds from the red Southwest Pass Wreck Lighted Buoy No. 2, which was discontinued in 1943 when the wreck was cleared to 54 ft. According to AWOIS records, the *Virginia* now is completely silted over (Hydrographic Office 1945; Berman 1972; Notice to Mariners 1943).

Three wrecks are recorded on bottom contour map No. E0905 (1979) at about 30 - 40 mi southwest of the project corridor. One wreck is located in a disused explosives dumping area (Figure 32).

Types of Non-Vessel Obstructions at the Mouth of Southwest Pass

The early work in the first decades of the 1800s on regulating the out-flow through the Southwest Pass may have created possible obstructions of cultural significance. Various materials were used in the construction of the jetties and other structures. In 1837, it was reported to Congress that a wing dam was constructed at Southwest Pass. It consisted of a 5,733 ft long line of square and plank piles driven into the bed of the pass and banded together at and near the surface of the water by means of streamers, or ribands, iron spikes and bolts. Two million ft of yellow pine and cypress lumber was used along with five tons of iron bolts and spikes. The plank piles varied in length from twelve to thirty-five ft; the square piles were from twenty-five to forty-five ft long (US Congress 1858:57). (Figure 33)

The sea jetties were planned to be built from near Stake Island, on the west bank, and near East Point, on the east bank, and extend over the crest of the tidal bar and terminate in approximately 30 ft of water just beyond the bar. The jetties were to consist of riprap stone placed upon a heavy foundation mattress. The side exposed to the sea was to be shielded by stones sufficiently large to resist the pressure of battering sea waves. The mattress that was to go under the riprap was to be made of willows built in layers that crossed one another creating a thickness of at least three ft. They were to be held together by wood. The willow mattress was to be sunk and then covered by at least two ft of riprap (US Congress 1899:4-5).

Obstructions to Shipping in the Vicinity of Southwest Pass

Shipwrecks can be categorized by 1) type of incident (how) and by 2) place of incident (where). Incidents that cause ships to wreck include going ashore, burning, being stranded, foundering, colliding, exploding, and scuttling. Location of wreckage incident would be dependent on natural conditions (such as shallowness, shoals, weather, etc.) and obstructions caused by man. Many man-made obstructions in the Southwest project corridor could include vessel wrecks, submerged pipes, cable areas, spoil areas (dredged materials), and dump sites. In the area of dredged channels, shipwrecks do occur and must be dealt with as special items. A wreck could be moved, or if the job of moving it is too difficult or costly, a new channel may be dredged to avoid lifting the wreck entirely (Dist. Eng. Officer 1916). See Table 7 for listings of obstruction types.

The fields of debris may consist of vessels that sank and were abandoned; of wreckage left behind when the vessels were removed; of jettisoned cargoes as vessels attempted to lighten their ships to free themselves from the sea bottom; of channel markers such as beacons, buoys (basket, bell, lighted bell, bush, sea can, and whistle) (Figure 33 and Figure 34 Miss. River Comm. 1945), mud lump markers such as barrels (Figure 35), and during modern times, channel lights, oil platforms and capped oil wells (Figure 36).

Another source of cultural debris at the mouth of Southwest Pass may be the construction of jetties. Concern with controlling bar and shoal formation across the entrances of the Delta passes has historic antecedents. The first use of jetties in the area of the Mississippi Delta occurred in 1722,

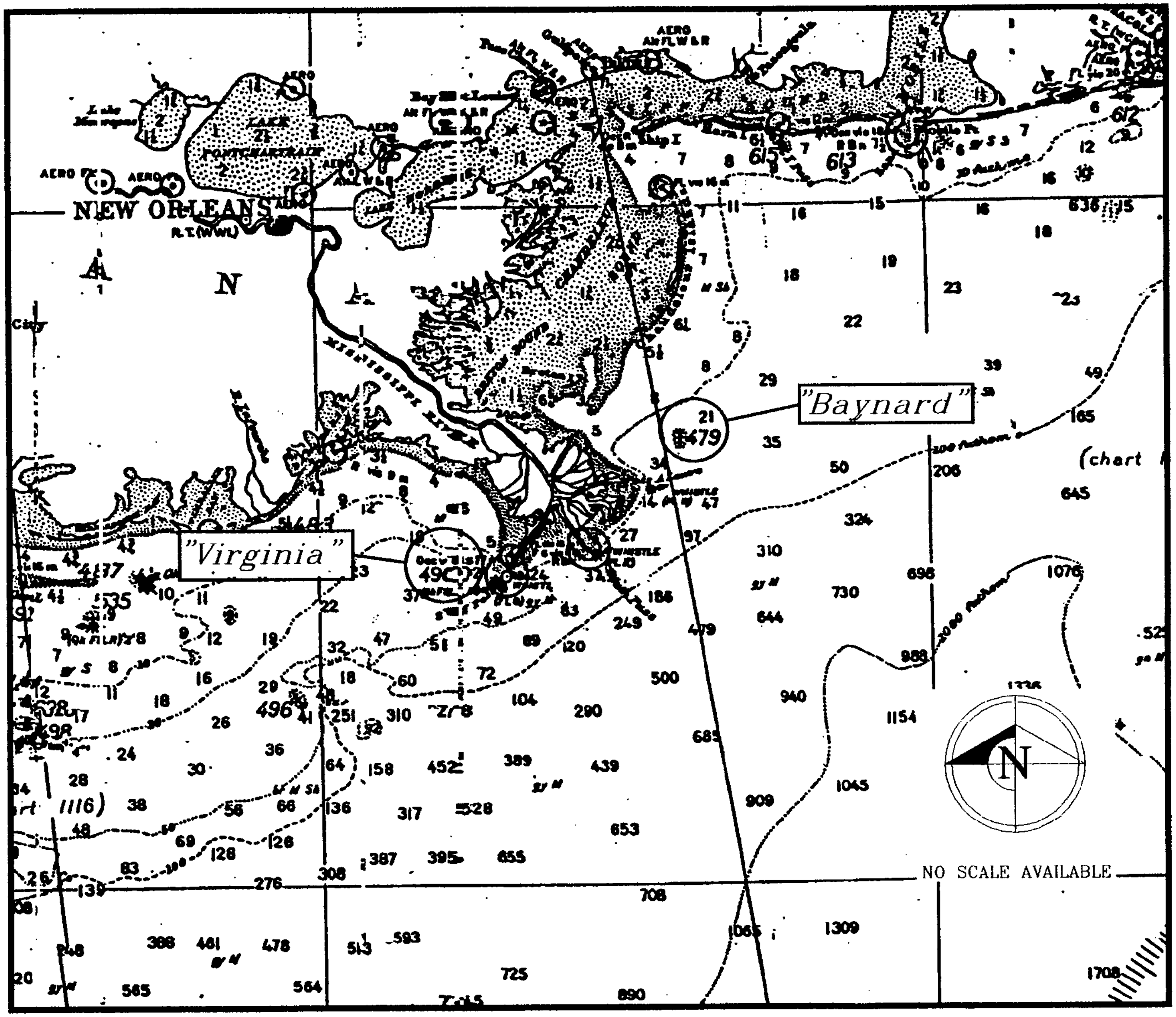

Figure 30. Excerpt from 1942 Navy Department Hydrographic Office map *Gulf of Mexico* locating the shipwrecks *Virginia* and *Baynard*.

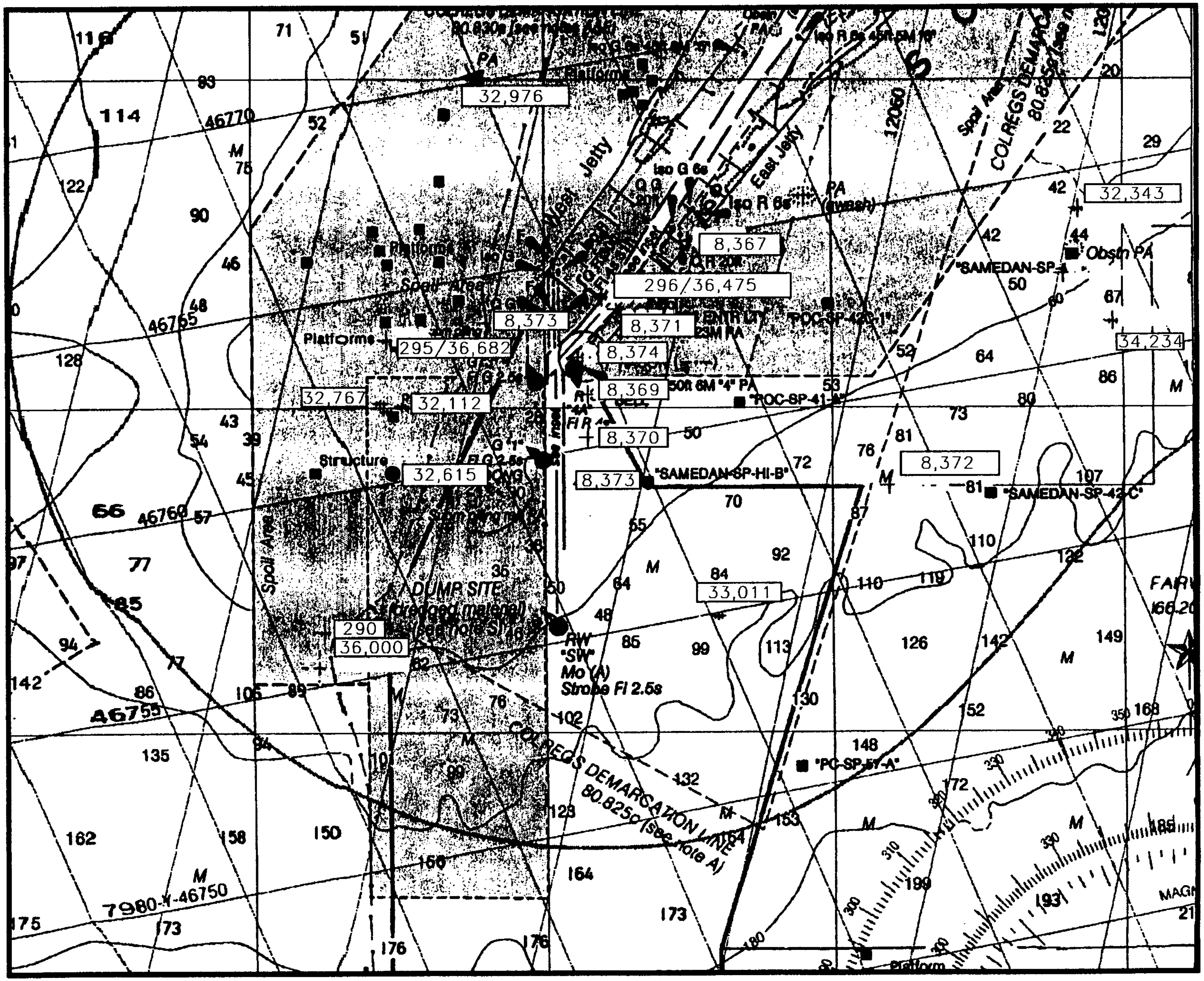

Figure 31. Map produced by National Oceanic and Atmospheric Administration with AWOIS and Navy Department numbered wreck sites with the vicinity of the project area.

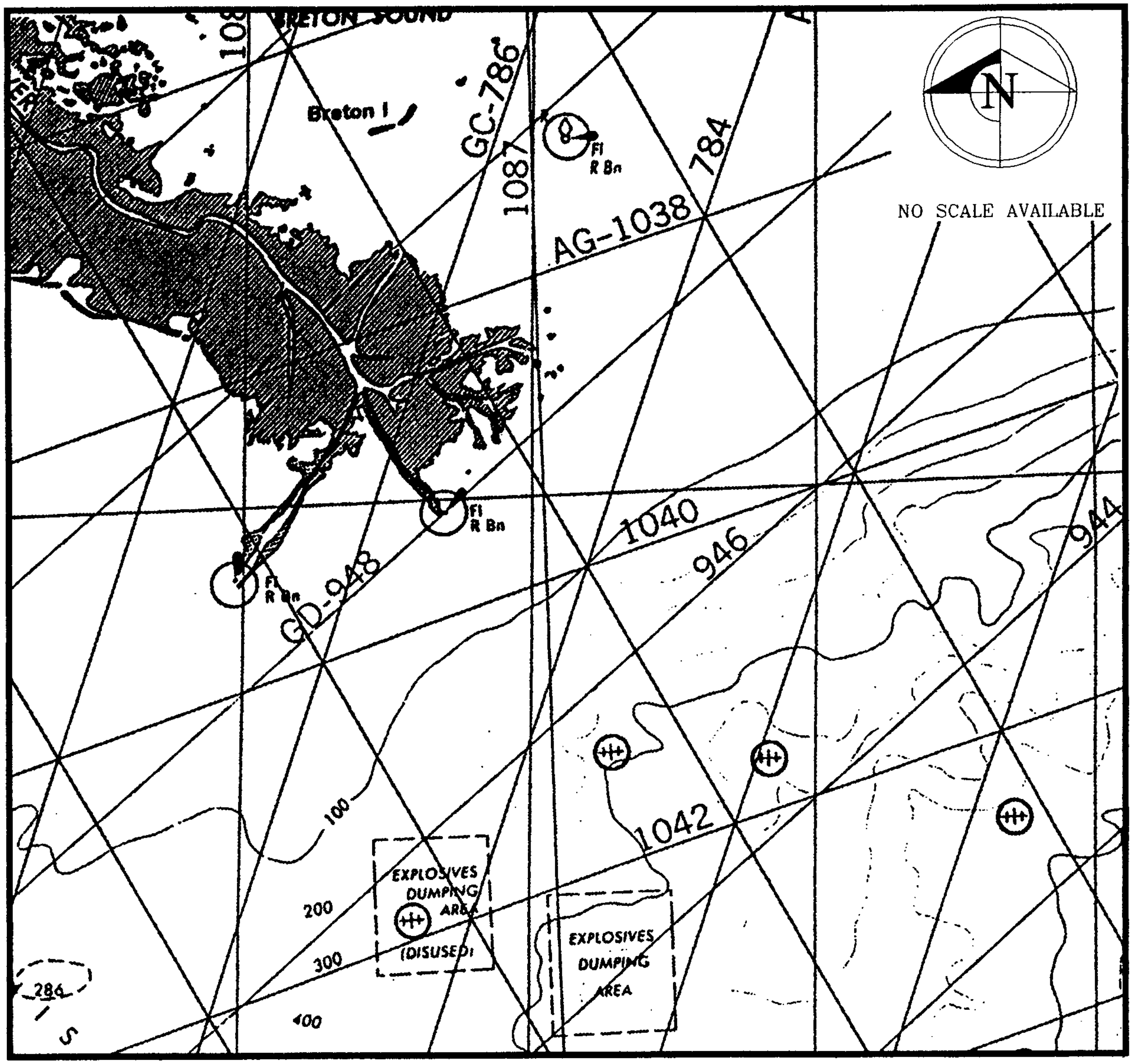

Figure 32. Excerpt from chart 1979 omega version bottom contour chart No. E0905 locating wrecks to the southeast of the project area.

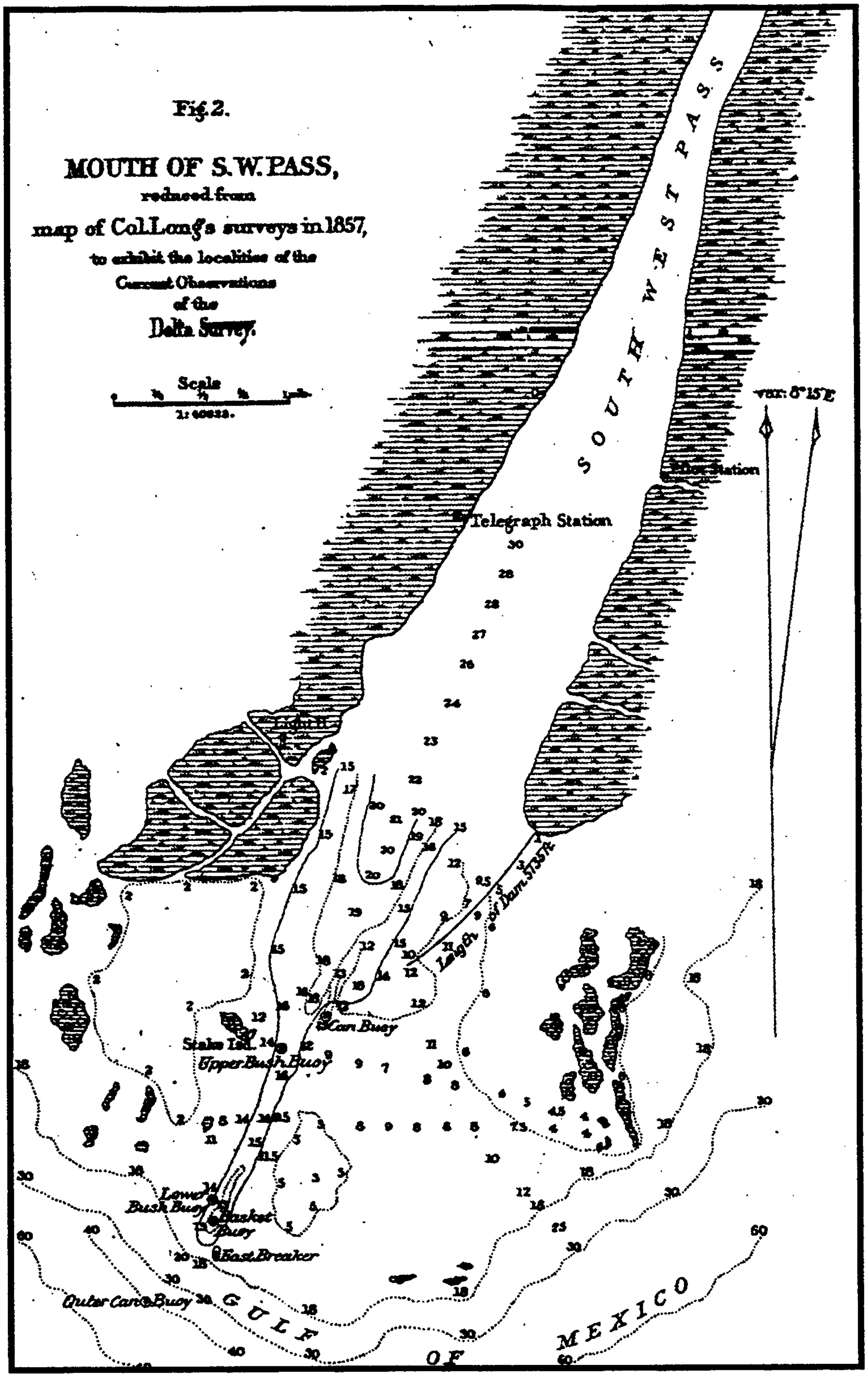

Figure 33. 1857 map *Mouth of S.W. Pass*, reduced from Col. Long's surveys, showing the wing dam on the east side of the Pass as well as buoy types and their placement in the Pass (Humphreys 1876).

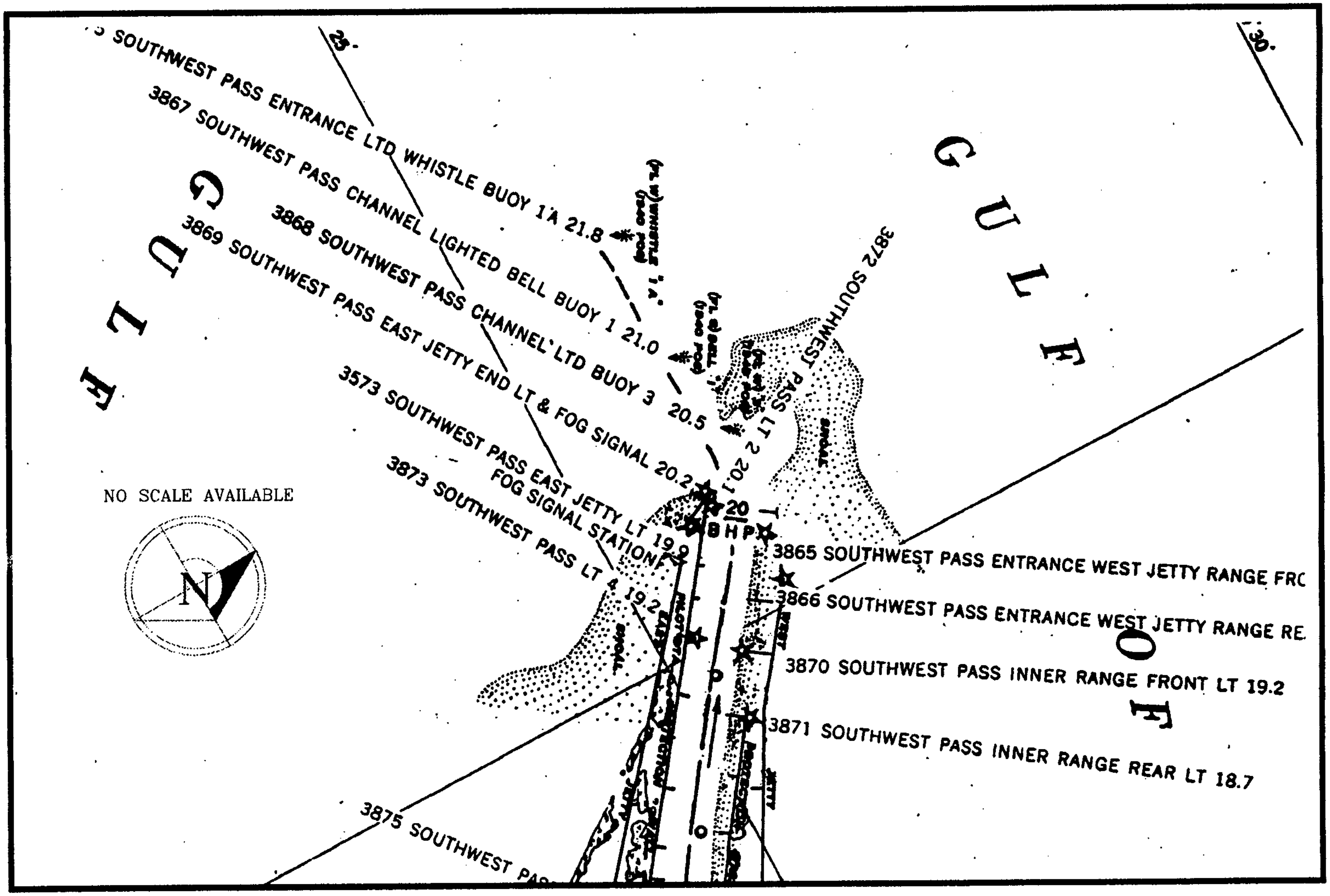

Figure 34. Excerpt from Mississippi River Commission's 1945 *Map of the Mississippi River, Cairo, Illinois to the Gulf of Mexico, Louisiana* showing modern day channel marker buoys and lights.

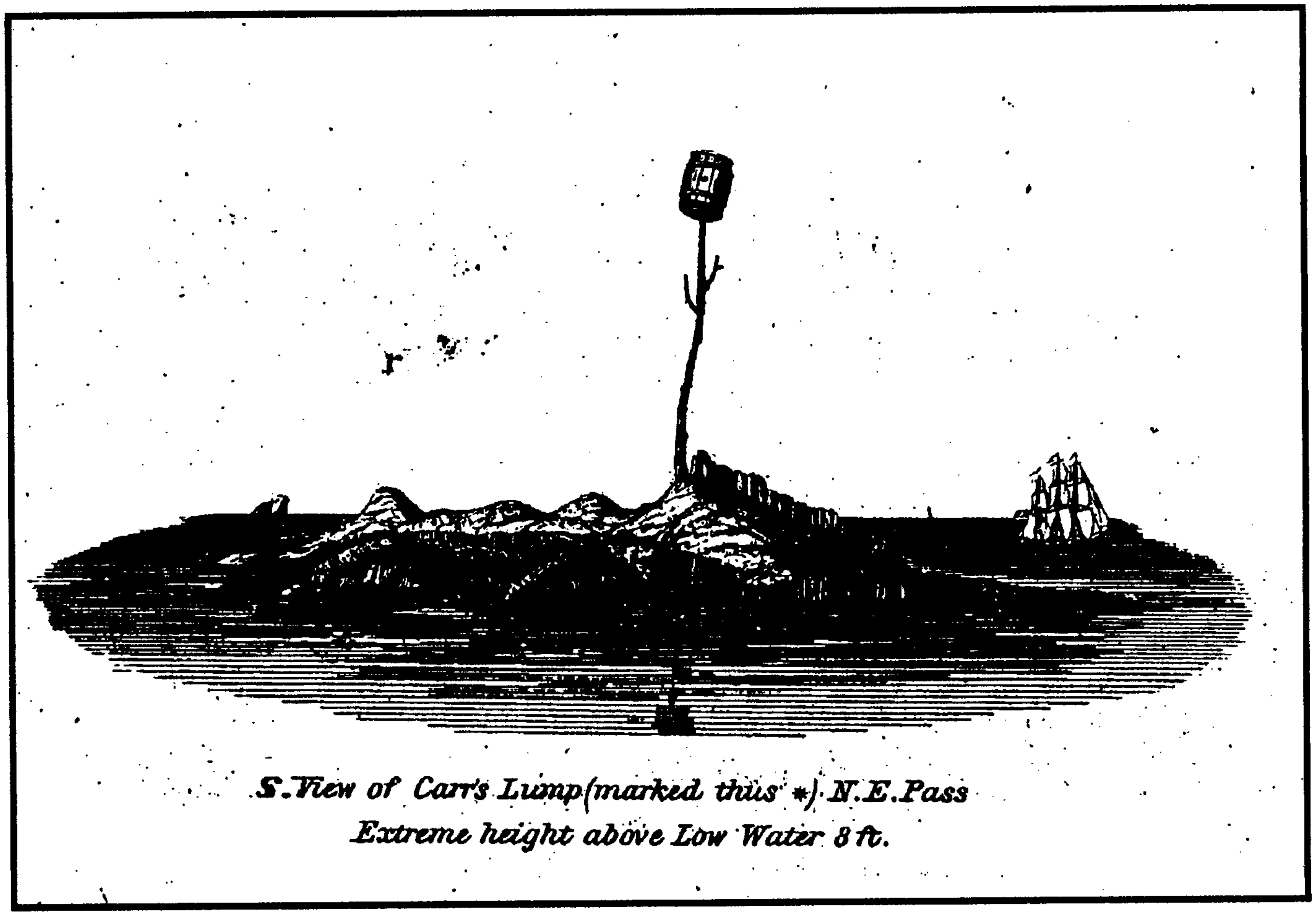

Figure 35. Detail of a mud lump as an example of how they could be marked for visual identification. From 1839 U.S. Army Corps of Engineers map *Delta of the Mississippi.*

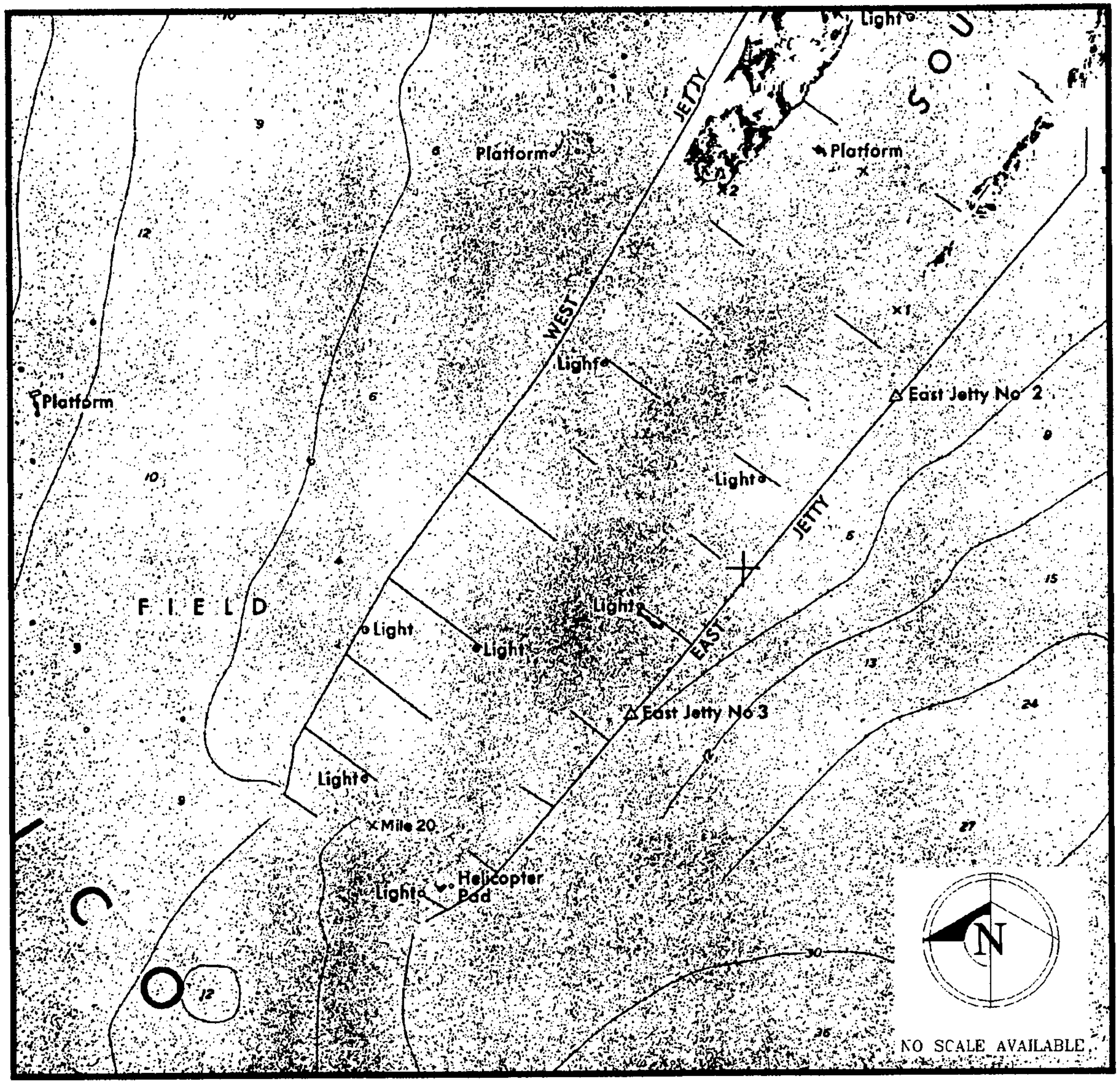

Figure 36. Excerpt from 1971 USGS topographic map quadrant Burrwood Bayou West, Louisiana, 7.5 min., showing modern day lights, oil well platforms, oil wells, and helicopter pad in the vicinity of the project corridor.

when the French government created a project for the improvement of the mouth of the Southeast Pass. But by 1728, the outlet of the river had so deteriorated that the project was abandoned (Dent 1921:13/15).

The United States Government was concerned with keeping the mouth of Southwest Pass open to shipping and commerce, and already in 1835 allocated monies for surveys and dredging. In 1853, the first jetty was built on the east side of Southwest Pass (Morgan 1971:130). Jetties were constructed in layers consisting of natural and manmade materials. At the very bottom, framed mattresses of willow were used. A frame mattress consisted of a three-ply willow mat secured between frames.

Willow mattresses have been used as a form of revetment in preventing river and levee bank erosion. A willow mattress can last a long time if not subject to attack by water currents, and when protected by a covering such as silt or, in the case of jetties by riprap, concrete, and other fill materials. Willow mattresses were used as a foundation stabilizer when building jetties in Southwest Pass. The use of willow mattresses in the Pass was meant to provide a flat and fixed base on a sea bottom that is soft from mud and shifting sands. Willow mattresses are particularly vulnerable at the water surface and at the toe area where undermining is likely (Barrows 1948:204,206). Because of water current action to the exposed areas of willow and timber mattresses, and renovation projects that have replaced the old jetties during the years, the possibility exists that remnants of the original willow mattresses, and the creosoted timber layers of the jetty foundation may still exist on the east and west side of the Pass. Figure 37 shows interweave of the mattresses that were used in the foundation of the jetties at Southwest Pass. Figure 38 depicts the variations in jetty construction commensurate with the levels of sea water it was to hold back. Jetties at the lowest level of water consisted of a simple structure of willow mattresses covered with random stone. The intermediate water level jetty had a layer of cross-wise timbers above the mattress that was topped by concrete block. The highest jetty consisted of a bottom layer of willow mattresses, topped by a layer of ordinary cross-wise timbers, two layers of creosoted cross-wise timbers, and concrete block. Figure 38 illustrates the fact that the width of foundation was much greater than the width of the concrete block, leaving the willow mattresses and timbers exposed to water action.

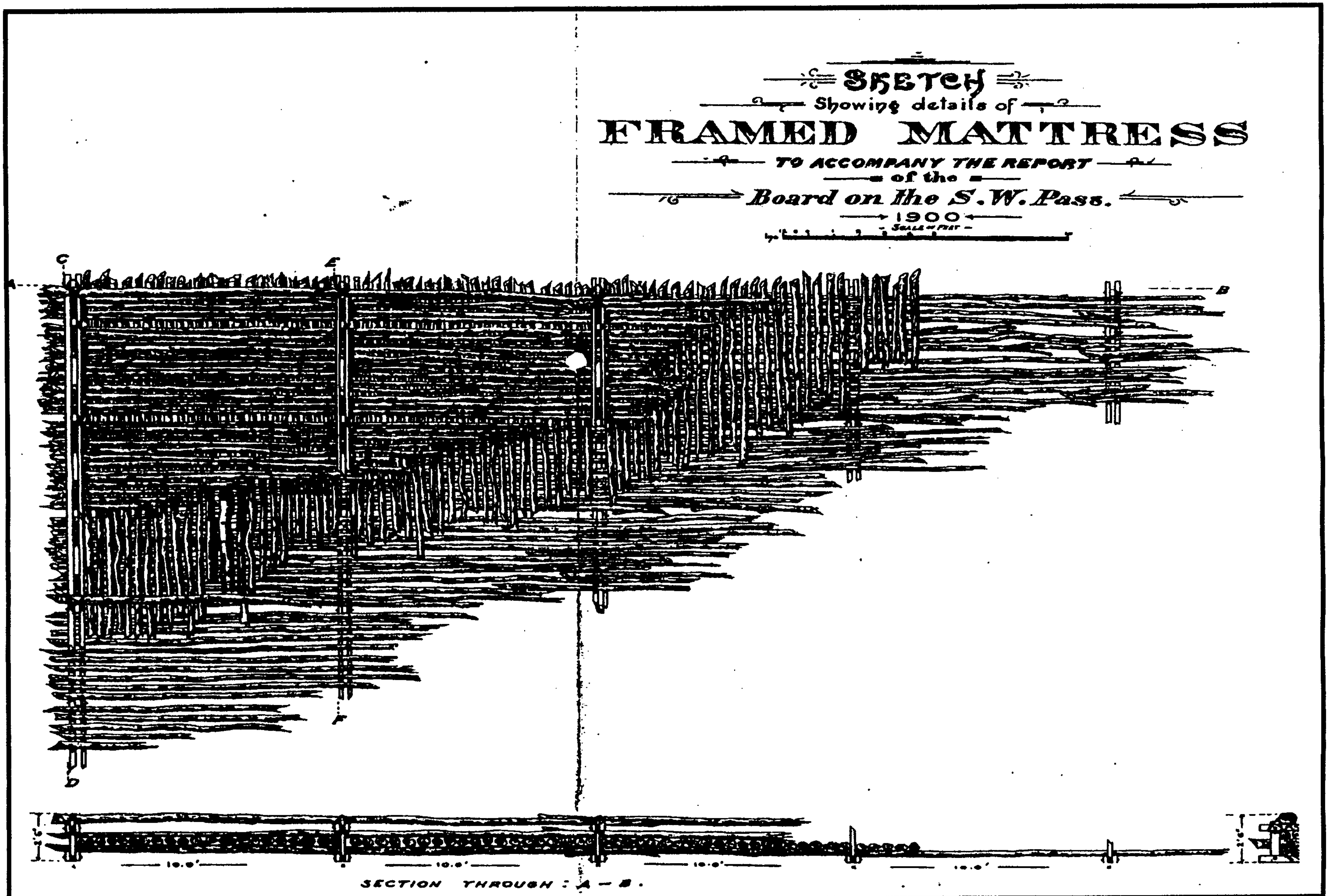

Figure 37. Sketch showing construction of framed mattresses used in the construction of the jetties at Southwest Pass. From US Congress Document No. 329, 1900.

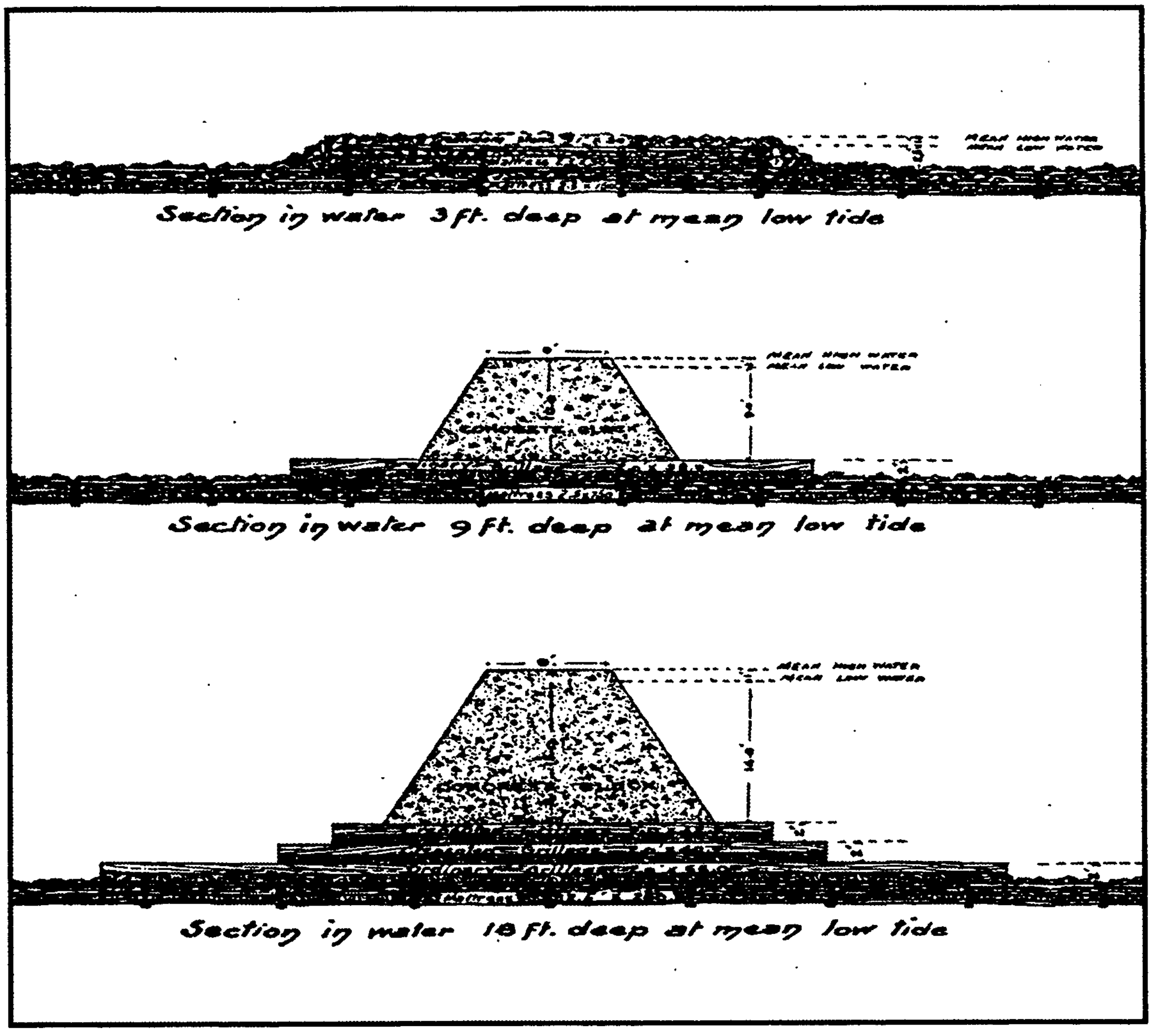

Figure 38. Sketch showing construction of jetties at Southwest Pass. From US Congress Document No. 329, 1900.

CHAPTER VII

SURVEY RESULTS

The following discussion reviews the results of the underwater cultural resources survey of the ODMDS area just outside of the Southwest Pass of the Mississippi River where it enters the Gulf of Mexico, Plaquemines Parish, Louisiana. A general overview and description of each target group of anomalies within the survey area is given below. Figure 39 shows the spatial distribution of the magnetic and acoustic anomalies. As noted in the previous chapter, these anomalies were identified initially by reading individual trackline data sets, rather than by contouring. After identification these anomalies were clustered into groups based on proximity and correlated with the acoustic anomalies and visual observations recorded during the survey. From these groups a target table (Table 8), and target map was developed (Figure 40). The magnetic anomalies within targets then were used in the production of magnetic contour plots. These contour plots then were analyzed for the presence of possible cultural resources that may be present beneath the sediment.

The survey area sits on the leading edge of the delta margin, with water depths from 12 to 200 ft. This region is considered to be prograding into the gulf with geologically unstable margins. Moderates to strong currents were encountered along the survey area's margin next to the main shipping channel. The distal margins had slower currents and greater depths.

Overview of the Survey Results

The survey area consisted of one block measuring approximately 3.67 mi in length and 1.2 mi wide. A total of 253 linear mi of sea bottom was surveyed. Water depths in the project area ranged from 12 ft to over 200 ft. Obstructions encountered during the survey included: abandoned oil pumping platforms, crew boats, and large ocean going freighters. A total of 2,335 individual magnetic anomalies (Table 9) and 72 individual acoustic anomalies (Table 10) were identified during this Southwest Pass ODMDS survey. Three hundred anomalies were grouped together as targets in areas of high density. These target groups were composed of anomalies of high amplitude or duration, or exhibiting complex magnetic signatures. These three hundred magnetic anomalies plus 23 correlated acoustic anomalies were organized into 119 targets. Each of these targets is discussed below. The remaining magnetic anomalies and acoustic anomalies constitute single, patternless point sources without correlations on adjacent tracklines. Analysis of these anomalies indicated that they represented very small areas of scattered, and presumably modern, isolated ferrous debris. The targets generally are numbered with the first target beginning in the northeast corner of the survey area running north to south with Target #119 near the southwest corner.

Special mention should be made of the high rate of sediment deposition in the survey area. Southwest Pass is one of the Mississippi River's major outlets; massive amounts of sediment flow over and onto the survey area annually. Due to this high rate of deposition, most targets that would be seen acoustically are quickly buried. This explains the relative

few acoustic anomalies detected, as compared to the large number of magnetic anomalies found in this survey.

Target Analyses

Target #1

Target #1 consists of four magnetic disturbances (M6, M121, M122, and M123) and one acoustic anomaly (A4). Two of the magnetic anomalies (M6 and M121) are classified as medium amplitude multi-component disturbances registering 94 and 55 gammas respectively, and both had a medium duration of 11.5 seconds. M122 was a high amplitude dipolar anomaly (151 gammas) with a short duration of 3.9 seconds. M123 is a medium amplitude (94 gammas) positive monopolar anomaly with an extremely short duration of 1.1 seconds. One acoustic anomaly (A4) of short duration (3 seconds) was detected that correlated with one of the magnetic disturbances (M121).

Acoustic anomaly A6 is a linear anomaly extending along the bottom; it is believed to be debris that was discarded from a passing ship (Figure 41). The other magnetic disturbances probably represent an area of scattered, presumably modern, ferrous debris (Figure 42). The magnetic and acoustic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Therefore, no further study of Target #1 is recommended or warranted. (Note: graphics are provided for this target as an example of the scattered debris that is pervasive throughout the survey area.)

Target #2

Two magnetic disturbances (M7 and M8) comprise Target #2. M7 represents a medium amplitude monopolar disturbance of 62 gammas and of short duration of 3.3 seconds. M8 represents a medium amplitude multi-component disturbance of 70 gammas and of short duration of 9.3 seconds. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resources. Analysis of these anomalies indicated that they represent a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #2 is recommended.

Target #3

Target #3 represents two magnetic disturbances (M32 and M36). M32 represents a medium amplitude dipolar disturbance of 68 gammas and of long duration of 46.9 seconds. M36 represents a low amplitude multi-component disturbance of 29 gammas and has a short duration of 14.2 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies are not typical of a shipwreck or other potentially significant cultural resources. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #3 is recommended.

Target #4

Five magnetic disturbances (M98, M155, M156, M157, and M158) comprise Target #4. Four of these disturbances are positive monopolar anomalies (M98, M155, M156, and M157) and one is a dipole (M158). All of the anomalies have low-to-medium amplitude from 46 gammas (M158) to 115 gammas (M157). All of the anomalies also have short durations from 1.1 second (M157) to only 8.8 seconds (M98). No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #4 is recommended.

Target #5

Target #5 represents only one magnetic disturbance (M136) that is a medium

Figure 39 is located in the envelope at the end of the report.

Figure 40 is located in the envelope at the end of the report.

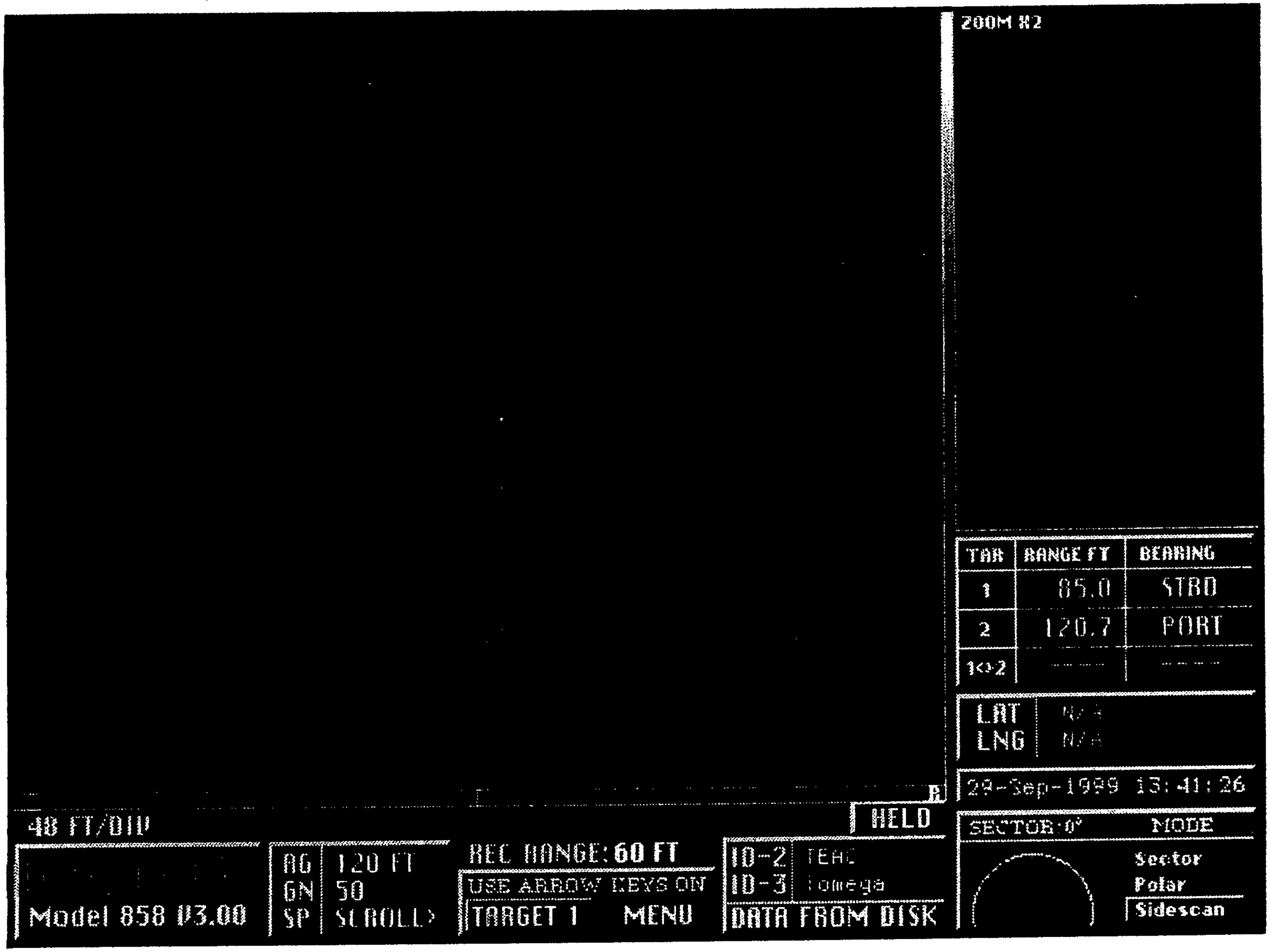

Figure 41. Side scan acoustic anomaly A4 is an image of a linear anomaly that correlates with magnetic Target #1.

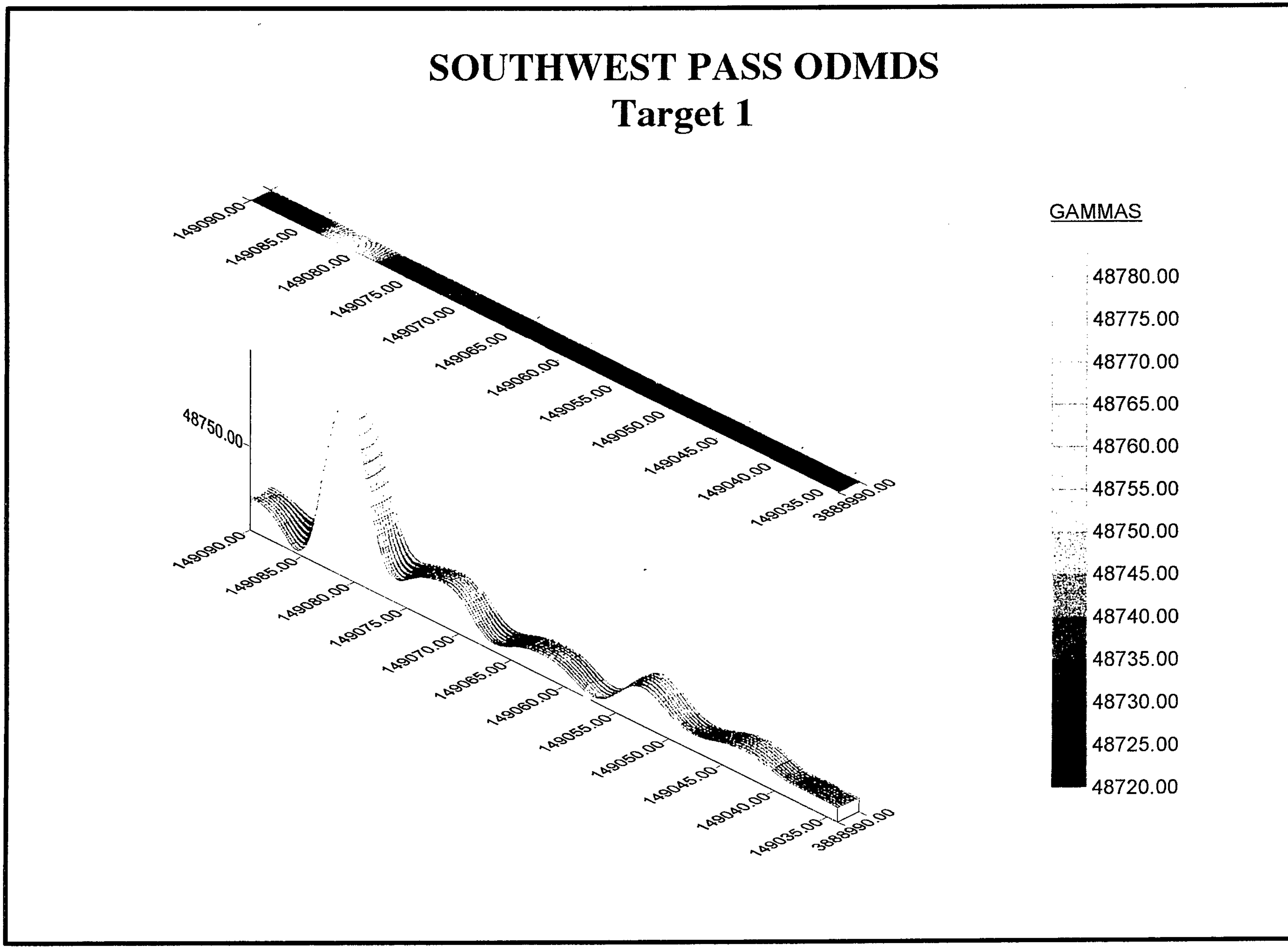

Figure 42. Magnetic contour plot of Target #1 as an example of the small area of scattered, and presumably modern, isolated ferrous debris found throughout the survey area.

amplitude dipole and of short duration. The magnetic attributes of the anomaly comprising this target are not typical of a shipwreck or other potentially significant cultural resources. Analysis of the anomaly indicated that it represented the magnetic signature of navigation buoy G "1" (Figure 43). Based on these data and on the absence of corresponding acoustic returns, no further study of Target #5 is recommended.

Target #6

Target #6 represents two magnetic monopolar anomalies of and short duration (M179 and M180). M179 has a medium amplitude of 57 gammas and runs for 3.8 seconds. M180 has a high amplitude of 109 gammas and runs for 3.8 seconds. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #6 is recommended.

Target #7

Two magnetic anomalies (M196 and M197) represent Target #7. M196 has a low amplitude of 27 gammas and has a short duration of 3.3 seconds. M197 has a high amplitude of 107 gammas and a short duration of 1.7 seconds. Both are monopolar disturbances. No acoustic anomalies were associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #7 is recommended.

Target #8

Target #8 represents only one magnetic disturbance (M257) that is a small-to-medium amplitude monopole and of short-to-medium duration. The magnetic attributes of the anomaly comprising this target are not typical of a shipwreck or other potentially significant cultural resources. Analysis of the anomaly indicated that it represented the magnetic signature of navigation buoy G "3" (Figure 44). Based on these data and on the absence of corresponding acoustic returns, no further study of Target #8 is recommended.

Target #9

Target #9 represents two magnetic disturbances (M301 and M302). M301 represents a low amplitude dipolar disturbance of 30 gammas and of short duration of 5.4 seconds. M302 represents a low amplitude monopolar disturbance of 21 gammas and has a very short duration of 3.3 seconds. No acoustic anomalies were associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resources. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #9 is recommended.

Target #10

Two magnetic anomalies (M346and M347) represent Target #10. M346 has a medium amplitude of 59 gammas and a short duration of 3.9 seconds. M347 has a high amplitude of 140 gammas and a short duration of 3.3 seconds. Both are dipolar disturbances. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #10 is recommended.

Target #11

Two magnetic anomalies (M518 and M519) represent Target #11. M518 has a low amplitude dipolar disturbance of 40 gammas and has a short duration of 5.5 seconds. M519 has a low amplitude multi-component disturbance of 25 gammas and a short duration of 3.8 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #11 is recommended.

Target #12

Target #12 represents two magnetic disturbances (M379 and M380). M379 represents a low amplitude monopolar disturbance of 13 gammas and of short duration of 4.9 seconds. M380 represents a low amplitude monopolar disturbance of 15 gammas and has a very short duration of 3.8 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #12 is recommended.

Target #13

Five magnetic anomalies (M402, M428, M477, M567, and M599) represent Target #13. Two of these (M428 and M567) are multi-component anomalies of low amplitudes, 15 gammas and 24 gammas, respectively. Two other anomalies (M402 and M477) in this cluster represent dipolar anomalies of small gamma readings, 14 gammas and 10 gammas respectively. The last magnetic disturbance in this cluster represents a low amplitude monopolar anomaly of 40 gammas. All anomalies have a short-to-medium duration with the shortest being 2.7 seconds (M402) and the longest being 7.1 seconds (M477 and M567)(Figure 45). This target appears to be associated with a charted shipwreck, as indicated by an older version of NOAA chart 11361. This shipwreck no longer is present in the current version of NOAA chart 11361 (NOAA 1999). This may indicate that the shipwreck has been salvaged, but, more likely the vessel has been disarticulated and buried. As noted in the geomorphology discussion, the mouth of Southwest Pass has a very high deposition rate, which results in rapid burial of materials on the cannel bottom. If the magnetic target does represent the shipwreck identified on the NOAA Chart, it is too deeply buried to register as an acoustic target. The addition of further fill is unlikely to negatively affect this potential resource and no further work is recommended in connection with this undertaking.

Target #14

Two magnetic anomalies (M413 and M414) represent Target #14. M413 has a low amplitude of 48 gammas and has a short duration of 4.3 seconds. M414 has a low amplitude of 25 gammas and a short duration of 5.5 seconds. Both are dipolar disturbances. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #14 is recommended.

Target #15

Target #15 represents two magnetic disturbances (M420 and M421). M420 represents a low amplitude multi-component disturbance of 10 gammas and of short duration of 8.7 seconds. M421 represents a low amplitude monopolar disturbance of 15

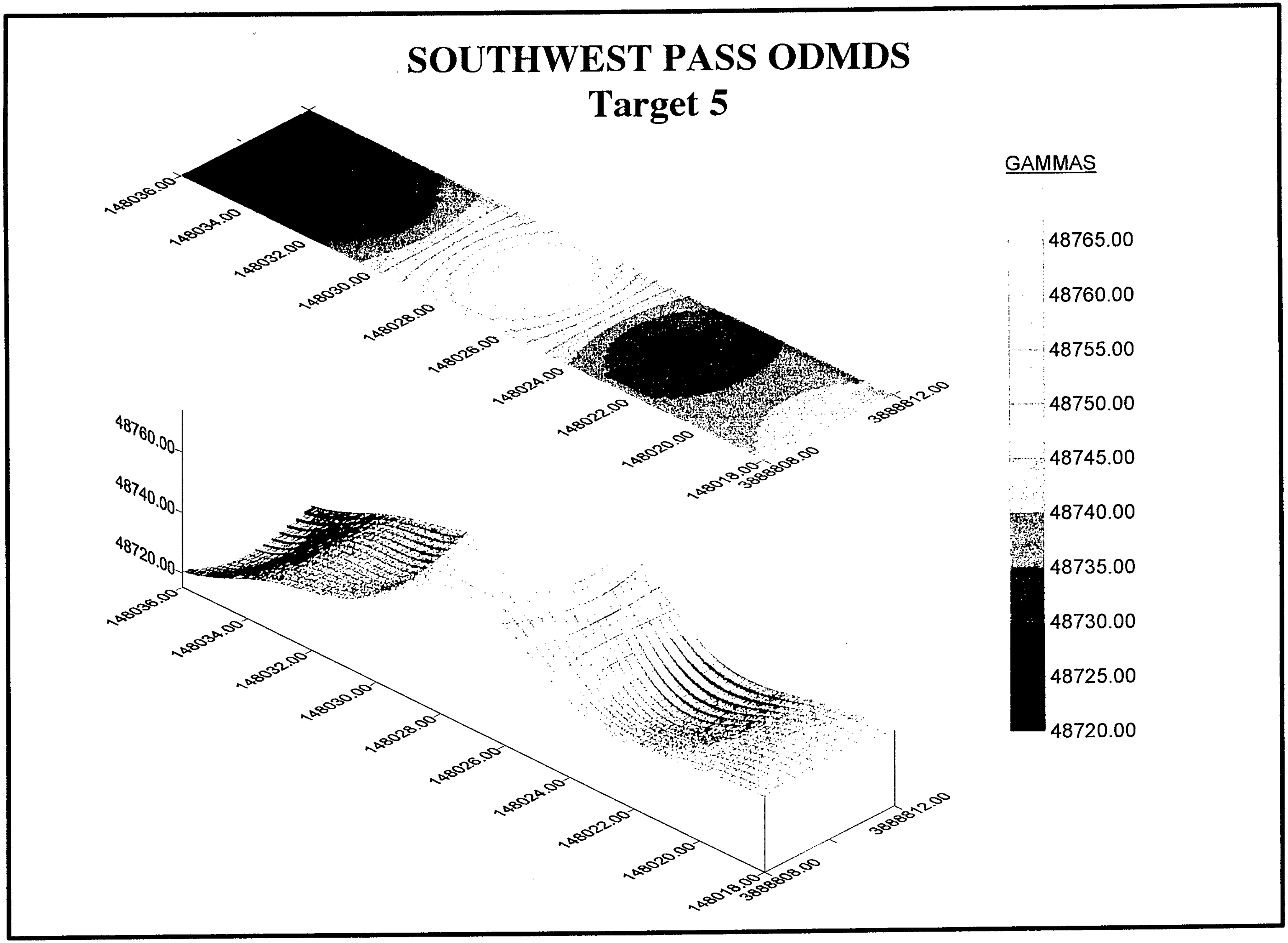

Figure 43. Magnetic contour surface plot of navigation buoy G "1" and modern debris both of which are included in Target #5.

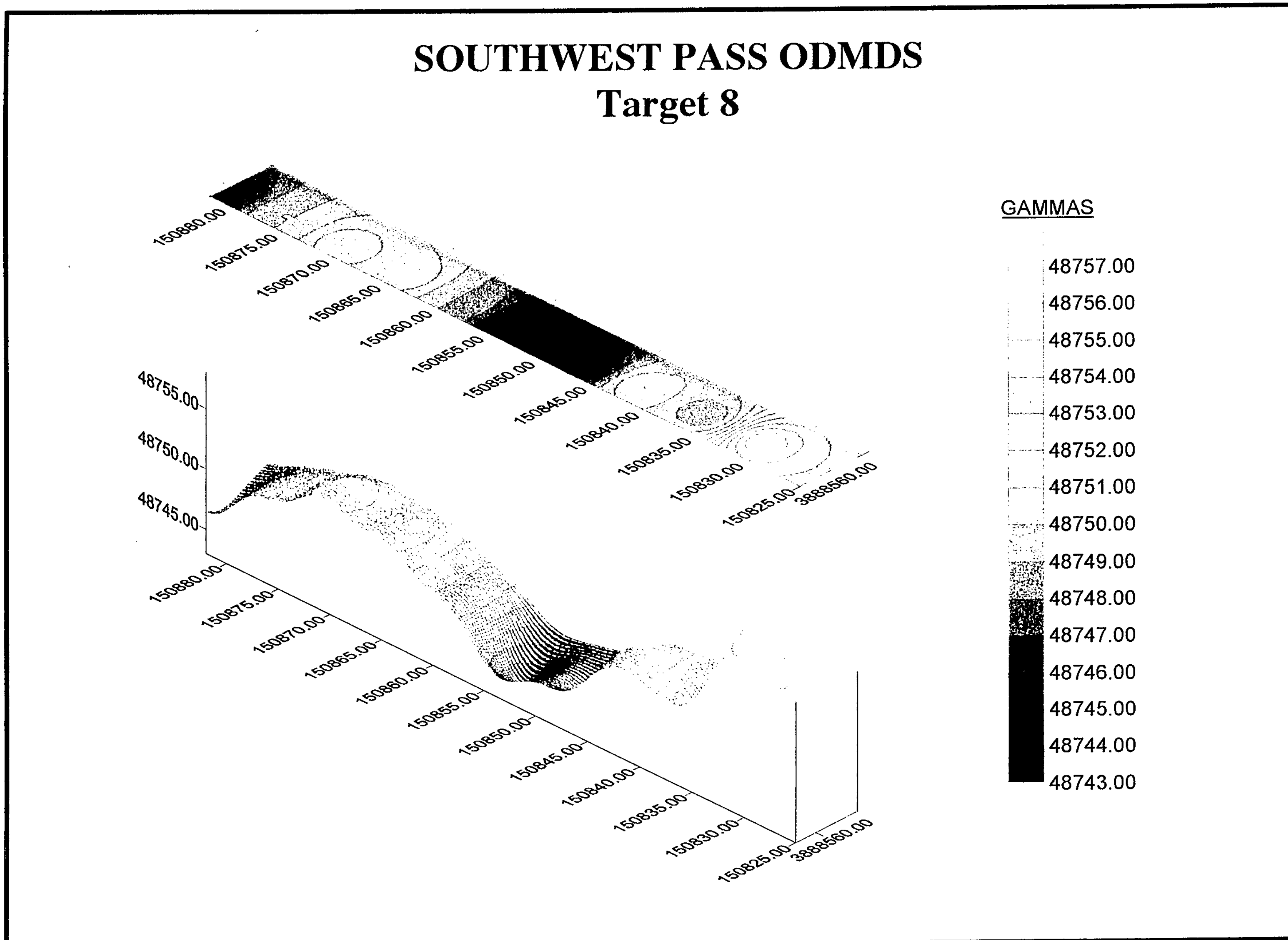

Figure 44. Magnetic contour surface plot of navigation buoy G "3" " and modern debris both of which are included in Target #8.

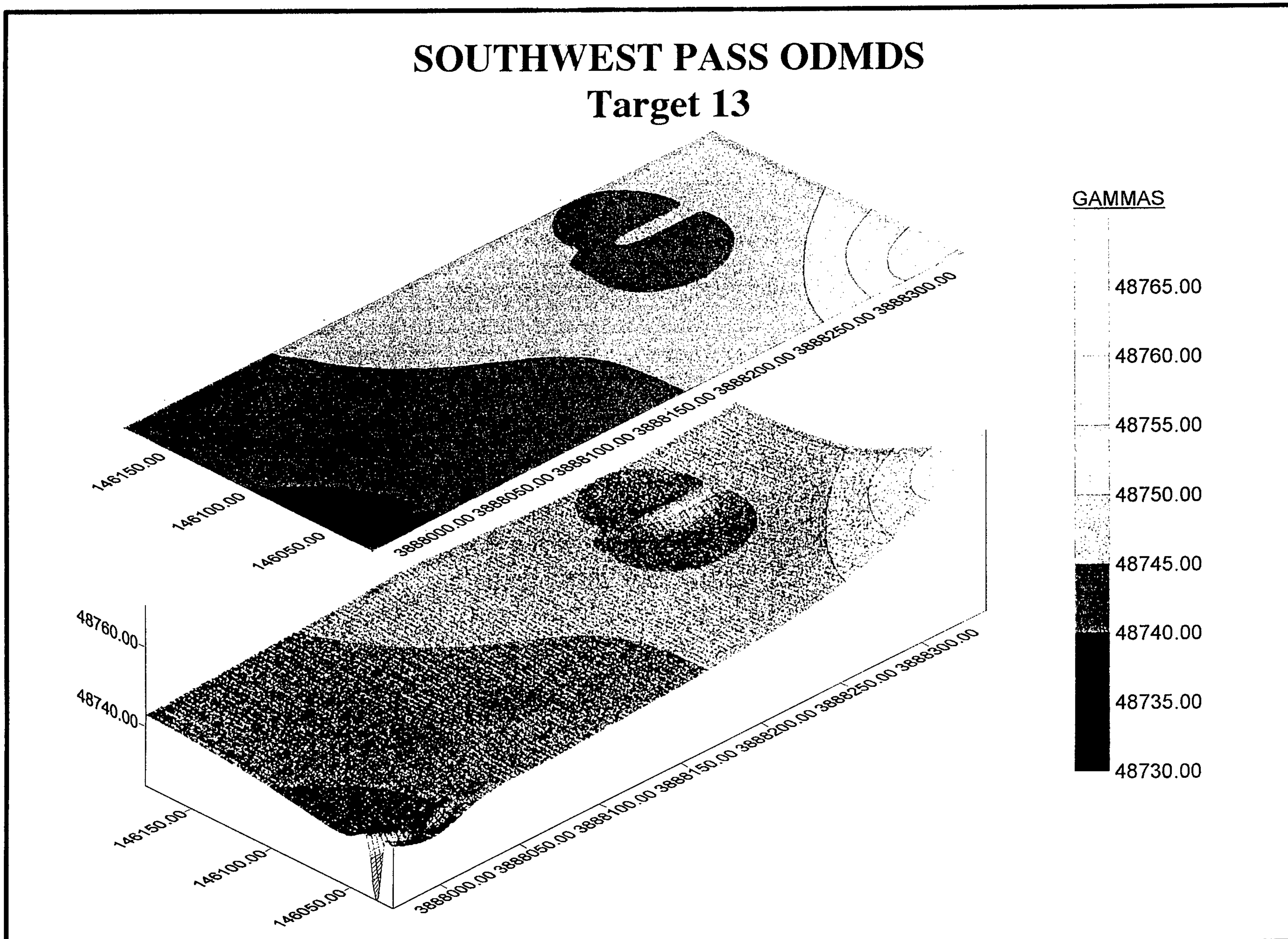

Figure 45. Magnetic contour plot of Target #13 This target may be associated with a known shipwreck, as indicated by an older version of NOAA chart 11361, but is no longer present in the current version of NOAA chart 11361.

gammas and has a short duration of 3.8 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #15 is recommended.

Target #16

Two magnetic anomalies (M441and M442) represent Target #16. M441 has a low amplitude of 17 gammas and a short duration of 8.7 seconds. M442 has a low amplitude of 19 gammas and a short duration of 3.8 seconds. Both are monopolar disturbances. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #16 is recommended.

Target #17

Target #17 represents two magnetic disturbances (M537 and M544). M537 represents a low amplitude dipolar disturbance of 24 gammas and of short duration of 6.6 seconds. M537 represents a low amplitude multi-component disturbance of 24 gammas and has a short duration of 8.2 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #17 is recommended.

Target #18

Target #18 represents two magnetic disturbances (M539 and M546). M539 represents a low amplitude multi-component disturbance of 40 gammas and of short duration of 6.1 seconds. M537 represents a low amplitude multi-component disturbance of 40 gammas and has a short duration of 6.1seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #18 is recommended.

Target #19

Target #19 represents two magnetic disturbances (M540 and M547). M540 represents a low amplitude dipolar disturbance of 11 gammas and of short duration of 5.5 seconds. M547 represents a low amplitude multi-component disturbance of 12 gammas and has a medium-to-short duration of 12 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #19 is recommended.

Target #20

This target represents three magnetic anomalies (M640, M641, and M789) of low magnetic amplitude and of short duration. M640 represents a low amplitude monopolar anomaly of 21 gammas and has a short duration of 4.9 seconds. M641 represents a low amplitude dipolar anomaly of 24 gammas with a short duration of 4.4 seconds. M789 represents a low amplitude multi-component

anomaly of 13 gammas with a short duration of 7.1 seconds. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #20 is recommended.

Target #21

Target #21 represents two magnetic disturbances (M668 and M669). M668 represents a medium amplitude monopolar disturbance of 75 gammas and of short duration of 6.1 seconds. M537 represents a low amplitude multi-component disturbance of 40 gammas and has a short duration of 6.1seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #21 is recommended.

Target #22

Target #22 represents two magnetic disturbances (M671 and M672). M671 represents a low amplitude monopolar disturbance of 19 gammas and of short duration of 3.9 seconds. M672 represents a low amplitude dipolar disturbance of 46 gammas and has a very short duration of 3.3 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #22 is recommended.

Target #23

Two magnetic anomalies (M696 and M697) represent Target #23. M696 is a monopolar anomaly with a low amplitude of 28 gammas and has a short duration of 5.5 seconds. M697 is a multi-component anomaly with a low amplitude of 14 gammas and a short duration of 7.7 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #23 is recommended.

Target #24

Target #24 represents two magnetic disturbances (M730 and M731). M730 represents a low amplitude monopolar disturbance of 17 gammas and of short duration of 4.4 seconds. M731 represents a low amplitude dipolar disturbance of 15 gammas and has a short duration of 5.5 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #24 is recommended.

Target #25

Two magnetic anomalies (M841and M842) represent Target #25. M841 has a low amplitude of 21 gammas and has a short duration of 3.3 seconds. M842 has a low amplitude of 29 gammas and a short duration of 2.7 seconds. Both are monopolar disturbances. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this

target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #25 is recommended.

Target #26

Two magnetic anomalies (M879 and M880) represent Target #26. M879 has a low amplitude of 26 gammas and has a short duration of 2.8 seconds. M880 has a low amplitude of 33 gammas and a short duration of 2.2 seconds. Both are monopolar disturbances. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #26 is recommended.

Target #27

Two magnetic anomalies (M889 and M890) represent Target #27. M889 has a low amplitude of 34 gammas and has a short duration of 1.1 seconds. M880 has a low amplitude of 44 gammas and a short duration of 1.1 seconds. Both are monopolar disturbances. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #27 is recommended.

Target #28

This target represents three magnetic anomalies (M897, M898, and M899) of low magnetic amplitude and of short duration. M897 represents a low amplitude monopolar anomaly of 22 gammas and has a short duration of 1.6 seconds. M898 represents a low amplitude dipolar anomaly of 28 gammas with a short duration of 2.8 seconds. M899 represents a low amplitude multi-component anomaly of 21 gammas with a short duration of 1.6 seconds. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #28 is recommended.

Target #29

Target #29 represents two magnetic disturbances (M917 and M918). M917 represents a low amplitude monopolar disturbance of 26 gammas and of short duration of 1.7 seconds. M918 represents a low amplitude monopolar disturbance of 34 gammas and has a short duration of 2.2 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #29 is recommended.

Target #30

Two magnetic anomalies (M920 and M921) represent Target #30. M920 has a low amplitude of 37 gammas and has a short duration of 1.6 seconds. M921 has a low amplitude of 47 gammas and a short duration of 2.2 seconds. Both are monopolar disturbances. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource.

Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #30 is recommended.

Target #31

Two magnetic anomalies (M965 and M966) represent Target #31. M965 has a low amplitude of 27 gammas and a short duration of 1.1 seconds. M966 has a low amplitude of 24 gammas and a short duration of 1.7 seconds. Both are monopolar disturbances. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #31 is recommended.

Target #32

Two magnetic anomalies (M982 and M983) represent Target #32. M982 has a low amplitude of 21 gammas and a short duration of 1.1 seconds. M983 has a low amplitude of 27 gammas and a short duration of 1.7 seconds. Both are monopolar disturbances. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #32 is recommended.

Target #33

Two magnetic anomalies (M1004 and M1008) represent Target #33. M1004 has a low amplitude of 31 gammas and a short duration of 1.7 seconds. M1008 has a low amplitude of 35 gammas and a short duration of 1.6 seconds. Both are monopolar disturbances. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #33 is recommended.

Target #34

Target #34 represents two magnetic disturbances (M1006 and M1007). M1006 represents a medium amplitude monopolar disturbance of 75 gammas and of short duration of 1.7 seconds. M1007 represents a medium amplitude monopolar disturbance of 62 gammas and has a very short duration of 1.6 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #34 is recommended.

Target #35

This target represents three magnetic anomalies (M1027, M1028, and M1029) of low magnetic amplitude and of short duration. M1027 represents a low amplitude monopolar anomaly of 42 gammas and has a short duration of 2.2 seconds. M1028 represents a low amplitude monopolar anomaly of 28 gammas with a short duration of 1.6 seconds. M1029 represents a low amplitude monopolar anomaly of 30 gammas with a short duration of 1.1 seconds. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and

presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #35 is recommended.

Target #36

Two magnetic anomalies (M1030 and M1031) represent Target #36. M1030 has a low amplitude of 23 gammas and a short duration of 2.8 seconds. M1031 has a low amplitude of 21 gammas and a short duration of 2.8 seconds. Both are monopolar disturbances. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #36.

Target #37

Target #37 represents four magnetic anomalies (M1035, M1051, M1052, and M1053), all of which are monopolar. M1035 has a low amplitude of 26 gammas and a duration of 1.7 seconds. M1051 a low amplitude of 37 gammas and a duration of 1.6 seconds. M1052 has a low amplitude of 25 with a short duration of 1.1 seconds. M1053 has a low amplitude of 23 gammas with a short duration of .5 seconds (Figure 46). These anomalies may be associated with a charted shipwreck, as indicated by an older version of NOAA chart 11361 (NOAA 1995); this shipwreck no longer is present in the current version of NOAA chart 11361(NOAA 1999). This may indicate that this shipwreck has been salvaged, but more likely the vessel has been disarticulated and buried. No acoustic data corresponds with the magnetic data. This likely is due to the very high rate of deposition at the mouth of Southwest Pass, which results in rapid burial of materials on the Channel bottom. Thus, if the magnetic target does represent the shipwreck identified on the NOAA Chart, it currently is deeply buried. The addition of further fill is unlikely to negatively affect this potential resource. No further work is recommended in connection with this undertaking.

Target #38

Target #38 represents two magnetic anomalies (M1048 and M1049). M1048 represents a low amplitude monopolar anomaly of 28 gammas with a short duration of 2.8 seconds. M1049 represents a medium amplitude dipolar anomaly of 68 gammas with a medium duration of 15.9 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #38 is recommended.

Target #39

Two magnetic anomalies (M1069 and M1070) represent Target #39. M1069 has a low amplitude of 36 gammas and a short duration of 2.2 seconds. M1070 has a medium amplitude of 62 gammas and a short duration of 1.7 seconds. Both are monopolar disturbances. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #39 is recommended.

Target #40

Two magnetic anomalies (M1079 and M1080) represent Target #40. M1079 has a low amplitude of 31 gammas and a short duration of 1.1 seconds. M1080 has a low amplitude of 22 gammas and a short duration of 1.7 seconds. Both are monopolar

disturbances. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #40 is recommended.

Target #41

Target #41 represents two magnetic anomalies (M1081 and M1082). M1081 represents a medium amplitude monopolar anomaly of 52 gammas and has a short duration of 1.6 seconds. M1082 represents a low amplitude monopolar anomaly of 50 gammas with a short duration of 2.2 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #41 is recommended.

Target #42

Two magnetic anomalies (M1085 and M1086) represent Target #42. M1085 is a dipolar anomaly with a medium amplitude of 54 gammas and a short duration of 3.3 seconds. M1086 is a monopolar anomaly with a low amplitude of 23 gammas and a short duration of 1.2 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #42 is recommended.

Target #43

Two magnetic anomalies (M1098 and M1099) represent Target #43. M1098 has a low amplitude of 36 gammas and a short duration of 2.7 seconds. M1099 has a low amplitude of 47 gammas and a short duration of 1.6 seconds. Both are monopolar disturbances. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #43 is recommended.

Target #44

Target #44 represents three magnetic anomalies (M1100, M1101, and M1102), all of which are monopolar and have a short duration. M1100 has a low amplitude of 44 gammas, M1101 has a low amplitude of 36 gammas, and M1102 has a low amplitude of 47 gammas. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #44 is recommended.

Target #45

Two magnetic anomalies (M1118 and M1119) represent Target #45. M1118 has a low amplitude of 22 gammas and has a short duration of 2.1 seconds. M1119 has a low amplitude of 42 gammas and a short duration of 2.7 seconds. Both are monopolar disturbances. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource.

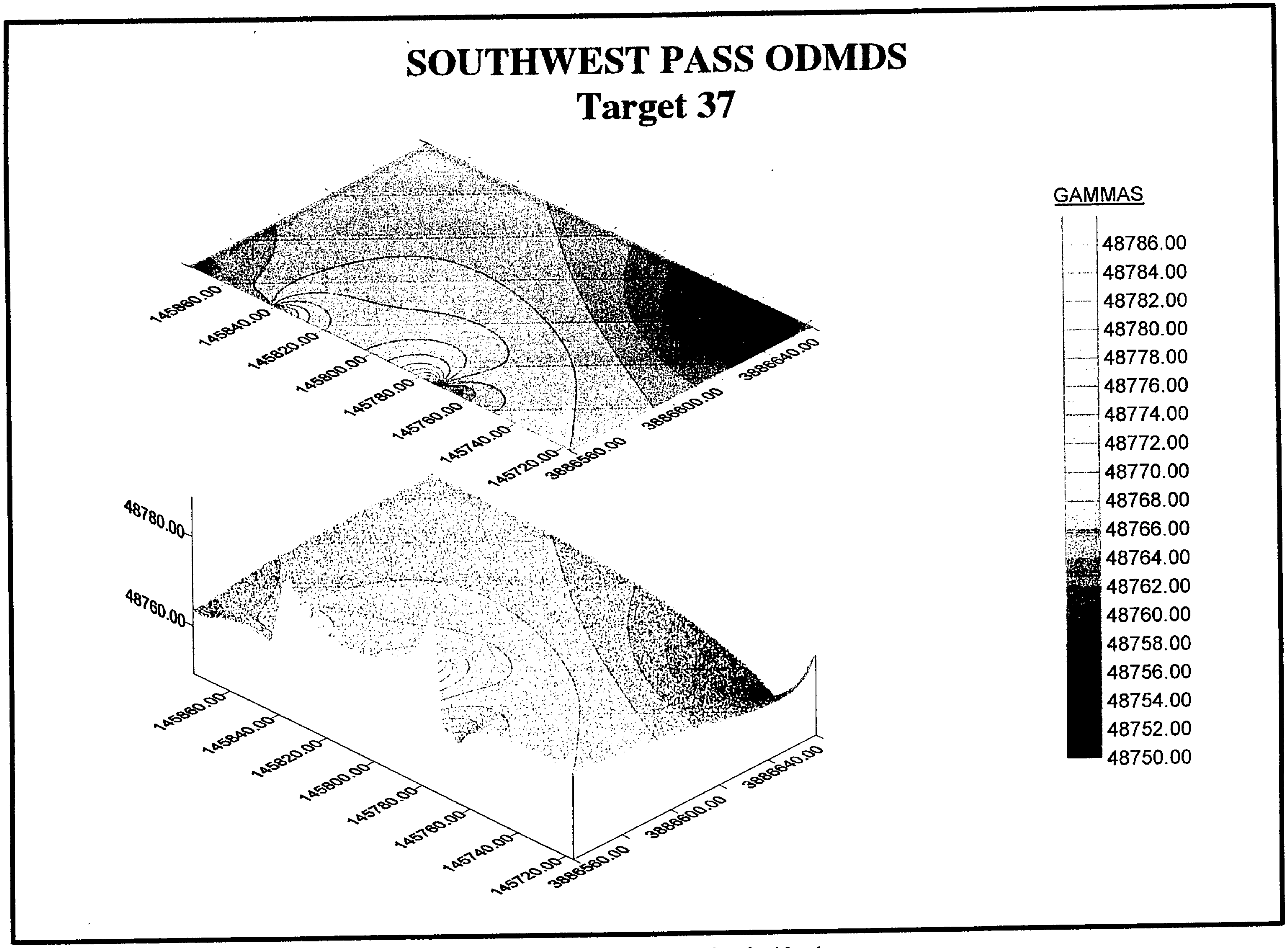

Figure 46. Magnetic contour plot of Target #37 This target may be associated with a known shipwreck, as indicated by an older version of NOAA chart 11361, but is no longer present in the current version of NOAA chart 11361.

Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #45 is recommended.

Target #46

Target #46 represents two magnetic disturbances (M1120 and M1121). M1120 represents a low amplitude monopolar disturbance of 22 gammas and of short duration of 1.1 seconds. M1121 represents a low amplitude monopolar disturbance of 29 gammas and has a short duration of 2.2 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #46 is recommended.

Target #47

Target #47 represents two magnetic disturbances (M1123 and M1124). M1123 represents a medium amplitude monopolar disturbance of 65 gammas and of short duration of 2.2 seconds. M1124 represents a low amplitude monopolar disturbance of 45 gammas and has a very short duration of 1.7 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #47 is recommended.

Target #48

Two magnetic anomalies (M1132 and M1133) represent Target #48. M1132 has a low amplitude of 37 gammas and has a short duration of 2.2 seconds. M1133 has a medium amplitude of 52 gammas and a short duration of 1.6 seconds. Both are monopolar disturbances. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #48 is recommended.

Target #49

Target #49 represents three magnetic anomalies (M1156, M1157, and M1158), all of which are monopolar and have a short duration. M1156 has a medium amplitude of 66 gammas, M1101 has a low amplitude of 25 gammas, and M1102 has a low amplitude of 22 gammas. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #49 is recommended.

Target #50

Two magnetic anomalies (M1160 and M1161) represent Target #50. M1160 has a low amplitude of 36 gammas and has a short duration of 1.7 seconds. M1161 has a medium amplitude of 62 gammas and a short duration of 1.1 seconds. Both are monopolar disturbances. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of

corresponding acoustic returns, no further study of Target #50 is recommended.

Target #51

Two magnetic anomalies (M1163 and M1164) represent Target #51. M1163 has a low amplitude of 20 gammas and has a short duration of 1.6 seconds. M1164 has a low amplitude of 48 gammas and a short duration of 1.1 seconds. Both are monopolar disturbances. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #51 is recommended.

Target #52

Target #52 represents two magnetic anomalies (M1167 and M1220) of high amplitude. M1167 has a signature of 221 gammas with a medium duration of 9.8 seconds. M1220 has a signature 0f 123 gammas with a short duration of 6.5 seconds. These anomalies may be higher in gammas than the other anomalies because of the closeness of the magnetic tow fish to the object and/or the shallowness of the water. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #52 is recommended.

Target #53

Two magnetic anomalies (M1169 and M1218) represent Target #42. M1085 is a dipolar anomaly with a medium amplitude of 54 gammas and has a short duration of 3.3 seconds. M1086 is a monopolar anomaly with a low amplitude of 23 gammas and a short duration of 1.2 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #42 is recommended.

Target #54

Target #54 represents three magnetic anomalies (M1172, M1173, and M1210), all of which are monopolar and have a short duration. M1172 has a low amplitude of 29 gammas; M1173 has a low amplitude of 21 gammas; and M1210 has a high amplitude of 131 gammas. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #54 is recommended.

Target #55

Two magnetic anomalies (M1174 and M1208) represent Target #55. M1174 has a low amplitude of 27 gammas and a short duration of 3.8 seconds. M1208 has a medium amplitude of 64 gammas and a short duration of 1.7 seconds. Both are monopolar disturbances. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #55 is recommended.

Target #56

Target #56 represents five magnetic anomalies (M1179, M1193, M1226, M1227, and M1228), all of which are monopolar. M1179, M1193, and M1228 all have a low amplitude of 30 gammas. M1226 has a low amplitude of 50 gammas. M1227 has a low amplitude of 27 gammas. All anomalies have a short duration with the shortest being 1.2 seconds (M1193) and the longest being 2.7 seconds (M1228). No acoustic anomalies are associated with this target. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #56 is recommended.

Target #57

Two magnetic anomalies (M1189 and M1190) represent Target #57. M1189 has a medium amplitude of 72 gammas and has a short duration of 1.1 seconds. M1190 has a medium amplitude of 81 gammas and a short duration of 2.2 seconds. Both are monopolar disturbances. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #57 is recommended.

Target #58

Target #58 represents two magnetic disturbances (M1213 and M1214). M1213 represents a medium amplitude monopolar disturbance of 66 gammas and of short duration of 2.2 seconds. M1214 represents a low amplitude monopolar disturbance of 49 gammas and has a short duration of 2.2 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #58 is recommended.

Target #59

Two magnetic anomalies (M1232 and M1233) represent Target #59. M1232 has a low amplitude of 21 gammas and has a short duration of 2.2 seconds. M1233 has a low amplitude of 22 gammas and a short duration of 2.2 seconds. Both are monopolar disturbances. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #59 is recommended.

Target #60

Target #60 is represented by 34 magnetic anomalies (M1256, M1323, M1353, M1364, M1382, M1391, M1392, M1434, M1435, M1557, M1572, M1573, M1574, M1620, M1644, 1645, M1646, M1817, M1862, M1919, M1951, M1952, M1955, M2037, M2038, M2040, M2165, M2210, M2295, M2296, M2316, M2321, M2327, and M2334) and one acoustic anomaly (A35). Five of the anomalies are multi-component (M1435, M1557, M1620, M1646, and M2295). Ten of the anomalies are dipolar (M1256, M1391, M1573, M1574, M1644, M1645, M1817, M2296, M2316, and M2334). Nineteen of the anomalies are monopolar (M1323, M1353, M1364, M1382, M1392, M1434, M1572, M1862, M1919, M1951, M1952, M1955, M2037, M2038, M2040, M2165, M2210, M2321, and M2327). The thirty-four anomalies range from low to high amplitude with the lowest being 8 gammas (M1434) and the highest being 103 gammas (M2295)

(Figure 47). The time length ranges from short to long with the shortest being 1.0 seconds (M1952) and the longest being 67.2 seconds (M2334). One acoustic anomaly (A35) of long duration (34 seconds) was detected which correlated with one of the magnetic disturbances (M1353). This acoustic disturbance is a pair of narrow linear anomalies ranging in length from approximately 46 – 107 ft long of medium to high reflectivity (Figure 48).

This target lies within a known mapped pipeline and/or cable corridor and represents structures associated with the petroleum extraction industry. Analysis suggests that this target is in fact the pipeline and does not represent a submerged cultural resource. Therefore, no further study of Target #60 is recommended.

Target #61

Two magnetic anomalies (M1263 and M1264) represent Target #61. M1263 is monopolar with a low amplitude of 33 gammas and a short duration of 1.1 seconds. M1264 is a dipole with a low amplitude of 30 gammas and a short duration of 2.7 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #61 is recommended.

Target #62

Target #62 represents two monopolar magnetic anomalies (M1266 and M1267) of low amplitude. M1266 has a signature of 31 gammas with a short duration of 2.8 seconds. M1267 has a signature of 38 gammas with a short duration of 2.2 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resources. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #62 is recommended.

Target #63

Six magnetic disturbances (M1271, M1272, M1273, M1274, M1275, and M1318) all of low amplitude represent Target #63. The minimum amplitude is 20 gammas (M1272 and M1275) and the maximum amplitude is 45 gammas (M1274). All anomalies were of short duration, the shortest being 1.1 seconds (M1271, M1272, and M1274) and the longest being 2.2 seconds (M1273 and M1275). Four of the disturbances are monopolar (M1271, M1272, M1274, and M1318) and two of the disturbances are dipolar (M1273 and M1275). No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #63 is recommended.

Target #64

Two magnetic anomalies (M1276 and M1277) represent Target #64. M1276 has a medium amplitude of 65 gammas and has a short duration of 1.6 seconds. M1277 has a low amplitude of 26 gammas and a short duration of 1.1 seconds. Both are monopolar disturbances. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of

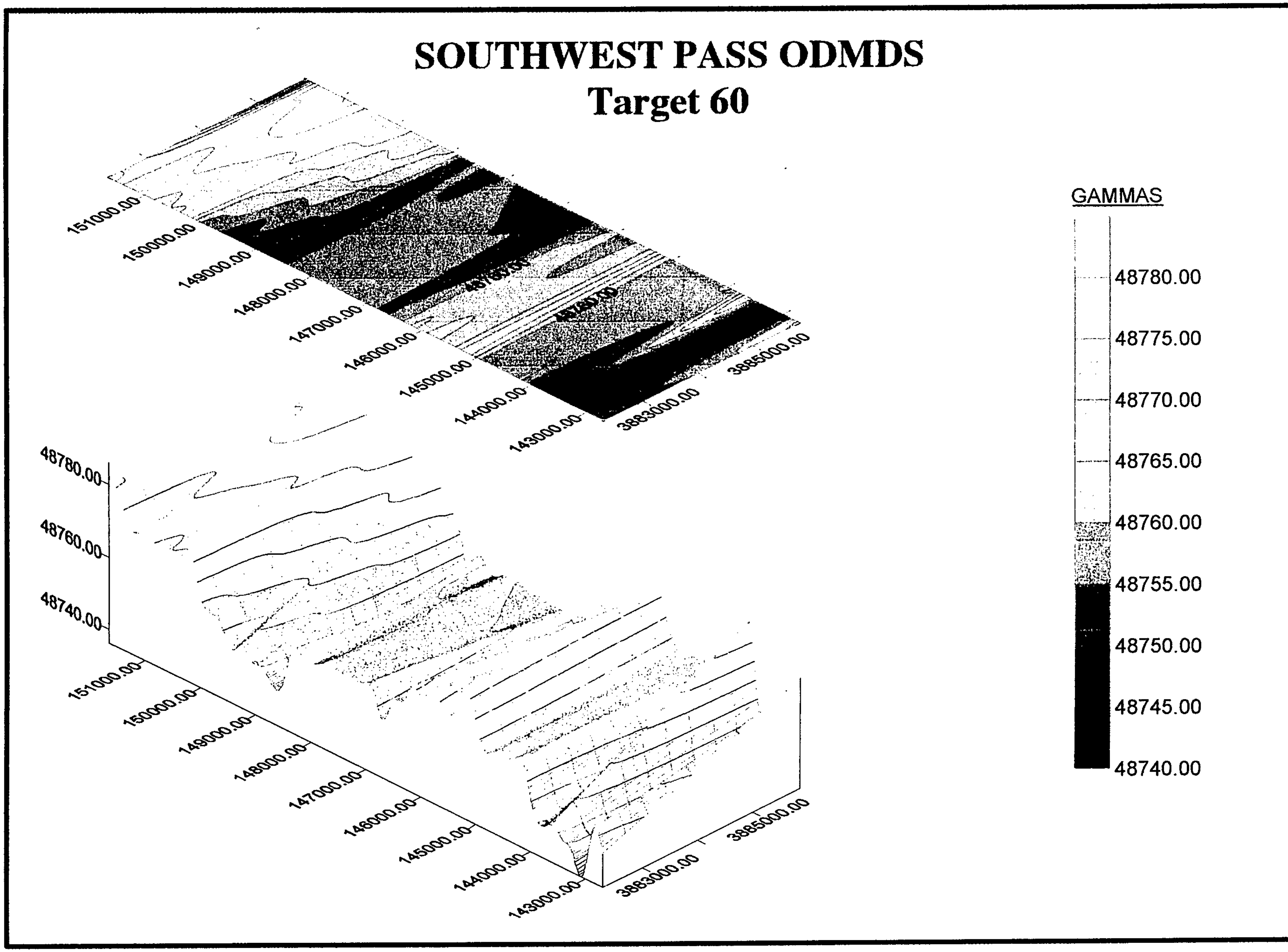

Figure 47. Magnetic contour surface plot Target #60. This target lies within a known mapped pipeline and/or cable corridor and represents structures associated with the petroleum extraction industry.

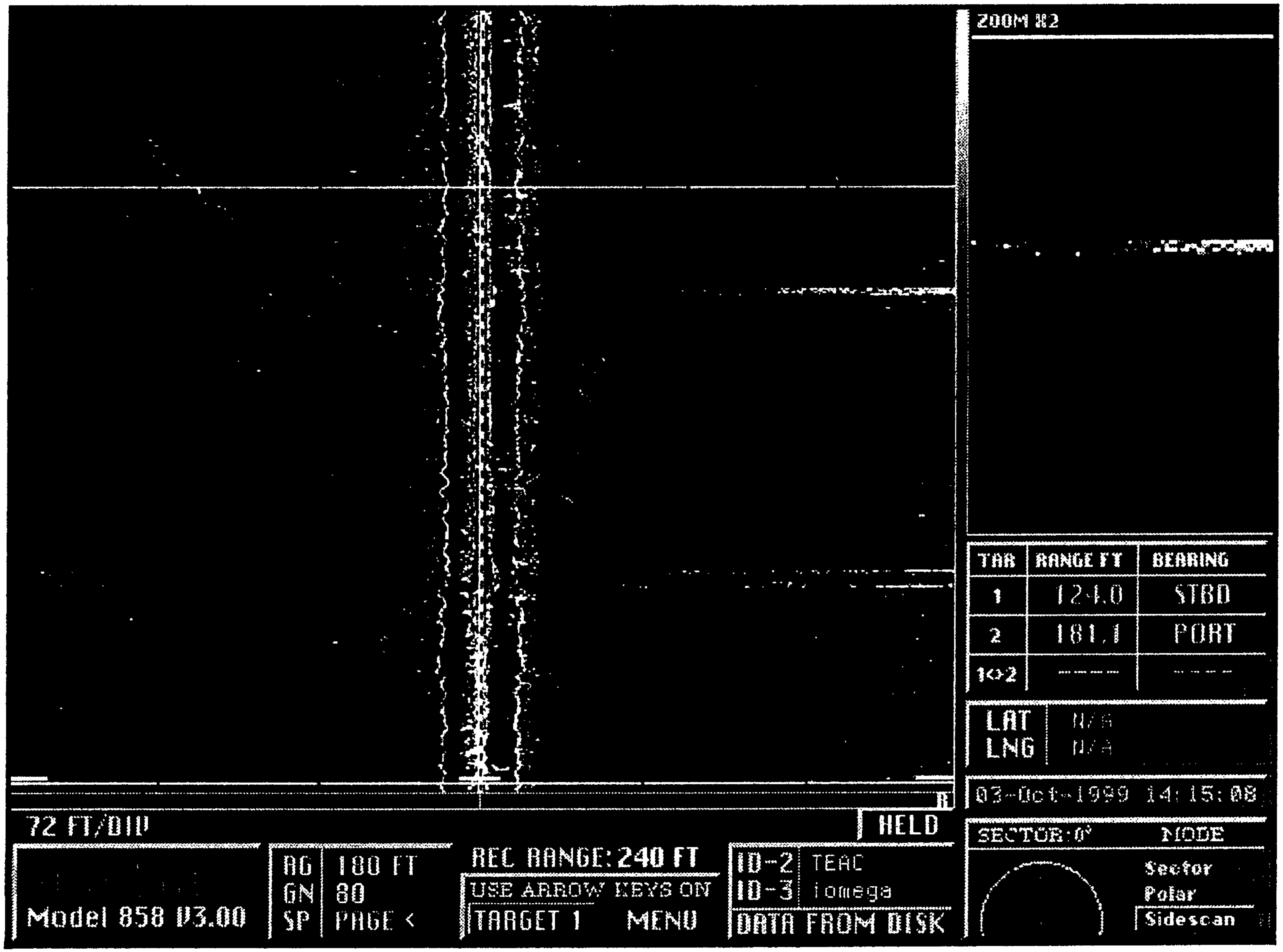

Figure 48. Side scan acoustic anomaly A35 that correlates with magnetic Target #60.

corresponding acoustic returns, no further study of Target #64 is recommended.

Target #65

Target #65 represents three magnetic anomalies (M1276, M1321, and M1350). M1276 represents a medium amplitude monopolar anomaly of 65 gammas and has a short duration of 1.6 seconds. M1321 represents a low amplitude monopolar anomaly of 23 gammas with a short duration of 2.8 seconds. M1350 represents a low amplitude monopolar anomaly of 21 gammas with a short duration of 2.2 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #65 is recommended.

Target #66

Two magnetic anomalies (M1279 and M1280) represent Target #66. M1279 has a low amplitude of 26 gammas and has a short duration of 1.6 seconds. M1280 has a low amplitude of 25 gammas and a short duration of 1.6 seconds. Both are monopolar disturbances. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #66 is recommended.

Target #67

Two magnetic anomalies (M1304 and M1305) represent Target #67. M1304 has a low amplitude of 22 gammas, has a short duration of 2.2 seconds, and is dipolar. M1305 has a low amplitude of 61 gammas, a short duration of 1.1 seconds, and is monopolar. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #67 is recommended.

Target #68

Two magnetic anomalies (M1330 and M1332) represent Target #68. M1330 is a dipolar anomaly with a low amplitude of 21 gammas and has a short duration of 1.6 seconds. M1332 is a monopolar anomaly with a low amplitude of 39 gammas and a short duration of 2.2 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #68 is recommended.

Target #69

Target #69 is represented by three monopolar, low amplitude, short duration magnetic anomalies (M1333, M1334, and M1335). M1333 is 30 gammas for 1.1 seconds. M1334 is 43 gammas for 2.7 seconds. M1335 is 27 gammas for 1.7 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #69 is recommended.

Target #70

Target #70 represents two monopolar magnetic anomalies (M1358 and M1359). M1358 has a medium amplitude signature of 58 gammas with a short duration of 1.6 seconds. M1359 has a low amplitude signature of 44 gammas with a short duration of 2.2 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #70 is recommended.

Target #71

Two magnetic anomalies (M1385 and M1387) represent Target #71. M1385 has a high amplitude of 245 gammas and has a medium duration of 11.0 seconds. M1387 has a high amplitude of 564 gammas and a medium duration of 12.6 seconds. Both are monopolar disturbances. No acoustic anomalies are associated with this target. The magnetic attributes of these anomalies (monopolar) are not typical of a shipwreck or other potentially significant cultural resources. Additionally, the short to moderately short duration of these anomalies does not indicate any complex ferrous structures. Analysis of these anomalies indicate that they represent scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #71 is recommended.

Target #72

Three magnetic anomalies (M1388, M1389, and M1390) and two acoustic anomalies (A41 and A42) represent Target #72. M1388 has a low amplitude of 48 gammas and a short duration of 1.6 seconds. M1389 has a low amplitude of 39 gammas and a short duration of 2.2 seconds. M1390 has a low amplitude of 36 gammas and a short duration of 3.3 seconds. M1388 and M1389 are monopolar disturbances and M1390 is a dipolar disturbance. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource.

A41 is an acoustic anomaly of short duration (4 seconds) which correlates with one magnetic disturbance (M1388). A41 is a small rectangular anomaly approximately 14 ft wide of medium to high reflectivity. A42 is an acoustic anomaly of short duration (5 seconds) which correlates with one magnetic disturbance (M1389). A42 is a narrow linear anomaly approximately 31 ft long of high reflectivity (Figure 49).

This target represents a scatter of debris that may be associated with the abandoned oil wells within the survey area. The nature of the magnetic anomalies and the characteristics of the corresponding acoustic anomalies do not represent a significant cultural resource. Therefore, no further study on Target #72 is recommended.

Target #73

Two magnetic anomalies (M1407 and M1408) represent Target #73. M1407 has a low amplitude of 29 gammas and has a short duration of 2.7 seconds. M1408 has a low amplitude of 25 gammas and a short duration of 2.8 seconds. Both are dipolar disturbances. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #73 is recommended.

Target #74

Two magnetic anomalies (M1462 and M1463) represent Target #74. M1462 has a low amplitude of 14 gammas and a short duration of 3.8 seconds. M1463 has a low amplitude of 33 gammas and a short duration of 6.7 seconds. Both are multi-component disturbances. No acoustic anomalies are

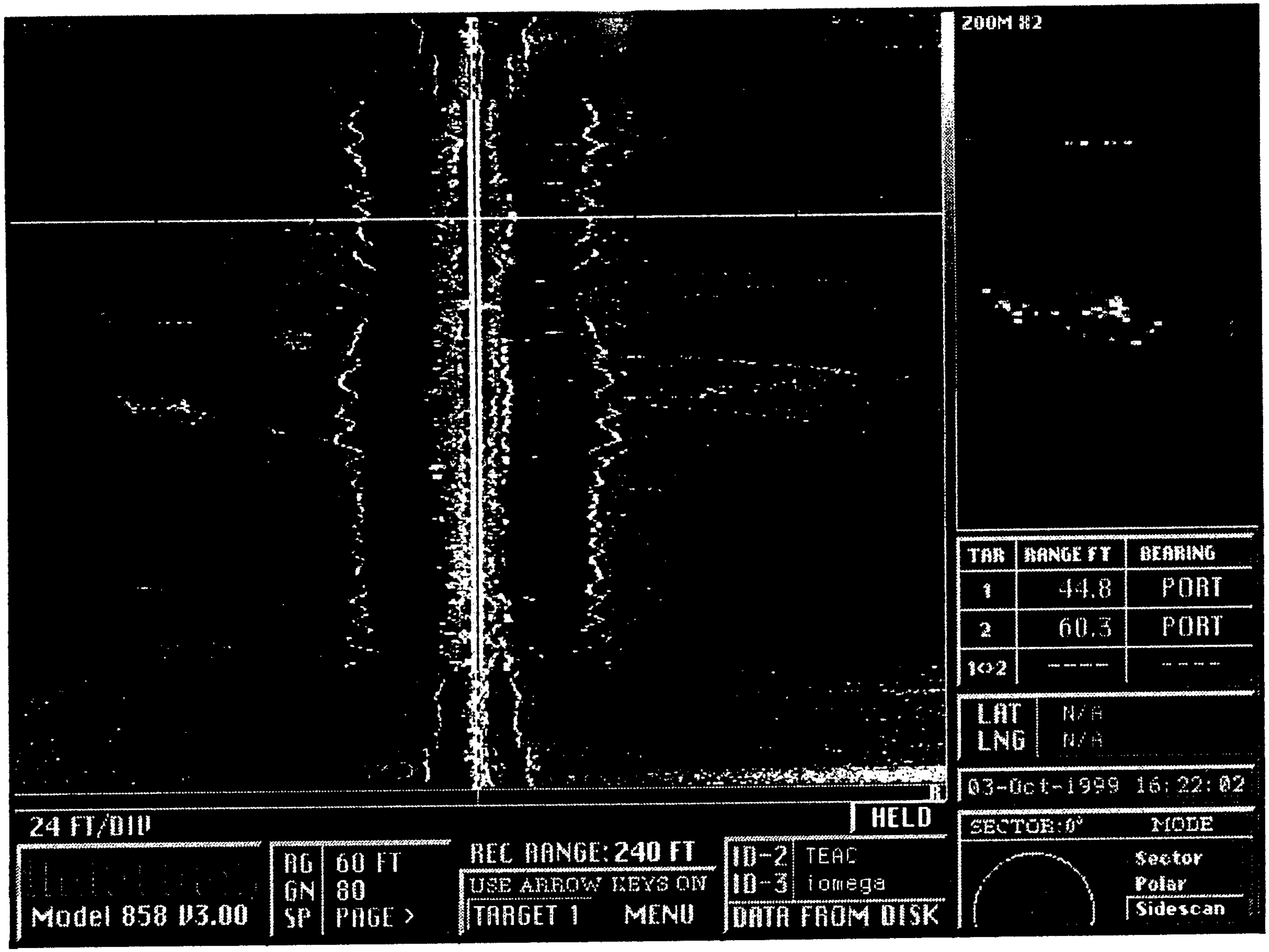

Figure 49. Side scan acoustic anomaly A42 that correlate with magnetic Target # 72.

associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #74 is recommended.

Target #75

Target #75 is represented by two magnetic disturbances (M1516 and M1517). M1516 is monopolar and has a low amplitude of 11 gammas and a short duration of 3.3 seconds. M1517 is dipolar and has a low amplitude of 14 seconds and a short duration of 5.5 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #75 is recommended.

Target #76

Target #76 consists of two magnetic disturbance (M1547 and M1548) and one acoustic anomaly (A46). M1547 has a low amplitude of 18 gammas and a short duration of 3.2 seconds. M1548 has a low amplitude of 16 gammas and a short duration of 3.3 seconds. Both magnetic anomalies are dipolar. One acoustic anomaly (A46) is associated with M1547 and has a short duration of 10 seconds. A46 is a narrow linear anomaly running parallel to the survey line (Figure 50).

This target represents a scatter of debris possibly associated with the high volume of boat traffic (tow cables or other deck debris) or abandoned oil wells (pipeline segments or cable lines) within the survey area. The characteristics of the magnetic disturbances, along with the accompanying acoustic anomaly do not indicate a significant submerged cultural resource. Therefore, no further study of Target #76 is recommended

Target #77

Three magnetic anomalies (M1621, M1641, and M1735) represent Target #77. M621 is monopolar with a high amplitude of 365 gammas and a long duration of 33.0 seconds. M1408 is multi-component with a low amplitude of 16 gammas and a short duration of 6.0 seconds. M1735 is monopolar with a medium amplitude of 63 gammas and a short duration of 7.7 seconds. No acoustic anomalies are associated with this target. The lack of corresponding acoustic anomalies indicates that the target is buried beneath sediments. Analysis of these anomalies indicates that they represent a ferrous mass buried beneath the sediment. The magnetic attributes of the anomalies comprising this target does not display the typical spacial characteristics of a shipwreck or other potentially significant cultural resource. Therefore, no further work is required on Target #77 at this time.

Target #78

Target #78 consists of two magnetic anomalies (M1661 and M1662). Both anomalies have low amplitudes of 14 gammas and are multi-component. Both M1661 and M1662 have medium a medium duration of 19.2 seconds and 14.8 seconds, respectively. No acoustic anomalies are associated with this target. The strength and duration of these anomalies indicates a small piece of ferrous material buried beneath the sediment. Therefore, no further work on Target #78 is recommended.

Target #79

Two magnetic anomalies (M1673 and M1674) represent Target #79. M1673 has a low amplitude of 14 gammas and has a short duration of 3.2 seconds. M1674 has a low amplitude of 44 gammas and a short duration of 3.3 seconds. Both are dipolar disturbances. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not

typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #79 is recommended.

Target #80

Two magnetic anomalies (M1685 and M1686) represent Target #80. M1685 is dipolar with a low amplitude of 17 gammas and a short duration of 2.8 seconds. M1686 is monopolar and has a low amplitude of 23 gammas and a short duration of 3.3 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #80 is recommended.

Target #81

Target #81 is composed of two monopolar, magnetic anomalies (M1710 and M1711). M1710 has a low amplitude of 36 gammas and a short duration of 1.6 seconds. M1711 has a low amplitude of 45 gammas and a short duration of 2.7 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #81 is recommended.

Target #82

Two low amplitude magnetic anomalies (M1714 and M1715) represent Target #82. Both anomalies are monopolar and short in duration. M1714 is 53 gammas and lasts for 1.7 seconds. M1715 is 40 gammas and lasts for 1.1 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #82 is recommended.

Target #83

Three magnetic disturbances (M1716, M1761, and M1762) make up Target #83. Two are monopolar (M1761 and M1762) and one is dipolar (M1716). M1716 has a low amplitude of 37 gammas with a short duration of 3.3 seconds. M1761 has a low amplitude of 37 gammas with a short duration of 2.2 seconds. M1762 has a low amplitude of 41 gammas with a short duration of 1.1 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #83 is recommended.

Target #84

Target #84 consists of two magnetic anomalies (M1717 and M1718). M1717 has a low amplitude of 44 gammas with a short duration of 1.7 seconds. M1718 has a low amplitude of 34 gammas with a short duration of 1.6 seconds. Both disturbances are monopolar. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent a small area of scattered, and

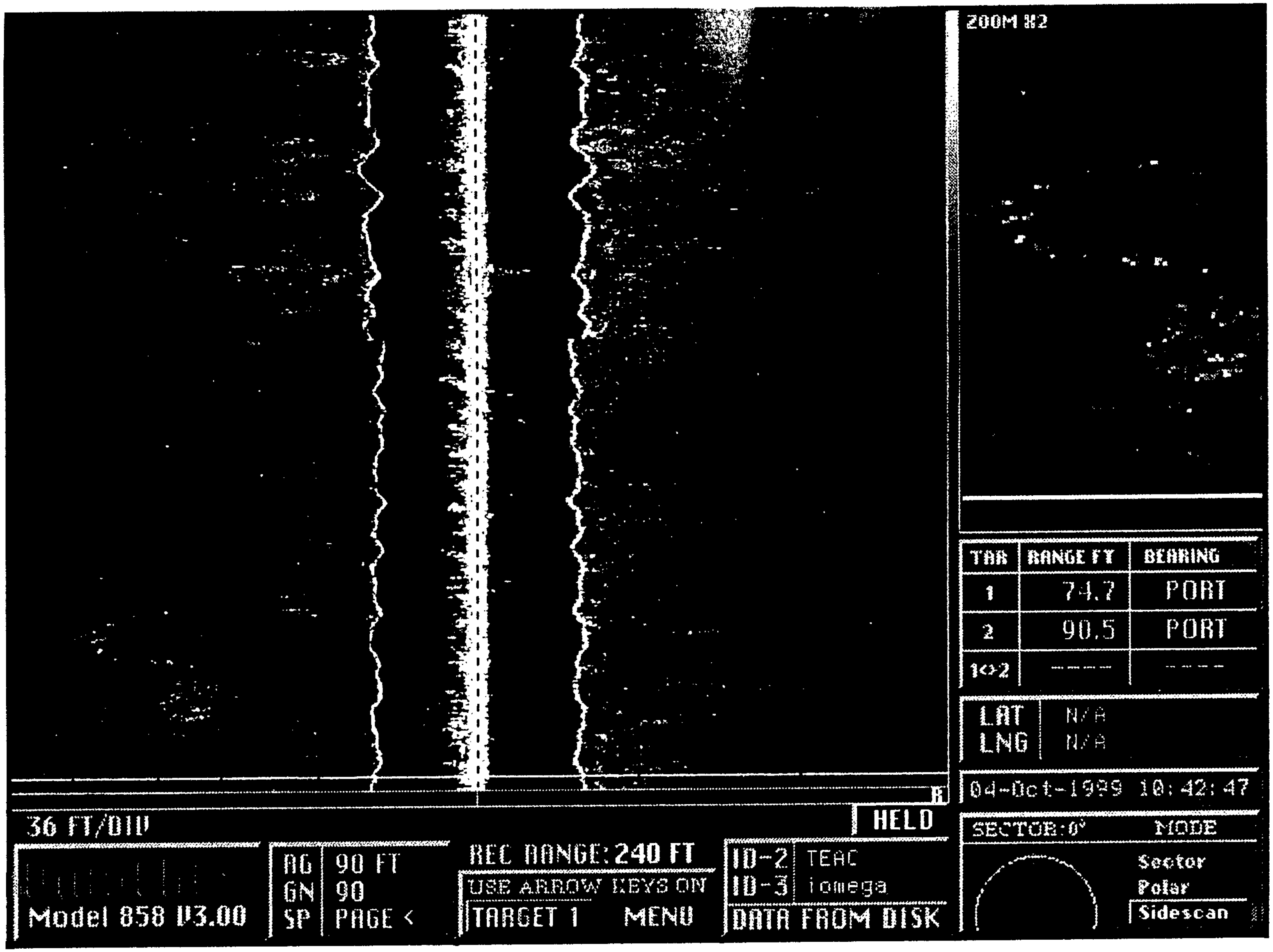

Figure 50. Side scan acoustic anomaly A46 that correlate with magnetic Target # 76.

presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #84 is recommended.

Target #85

Target #85 represents two low amplitude magnetic anomalies (M1739 and M1740). M1739 has an amplitude of 33 gammas and M1740 has an amplitude of 43 gammas. Both anomalies are monopolar and have a short duration of 2.2 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #85 is recommended.

Target #86

Two magnetic anomalies (M1764 and M1765) represent Target #86. M1764 is monopolar and has a low amplitude of 30 gammas and a short duration of 1.1 seconds. M1765 is monopolar and has a medium amplitude of 65 gammas and a short duration of 1.6 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #86 is recommended.

Target #87

Target #87 consists of two magnetic anomalies (M1769 and M1765). M1769 has a low amplitude of 35 gammas with a short duration of 1.1 seconds. M1765 has a low amplitude of 45 gammas with a short duration of 1.1 seconds. Both disturbances are monopolar. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #87 is recommended.

Target #88

Target #88 is composed of two monopolar, magnetic anomalies (M1779 and M1780). M1779 has a low amplitude of 44 gammas and a short duration of 1.7 seconds. M1780 has a medium amplitude of 84 gammas and a short duration of 1.1 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #88 is recommended.

Target #89

Target #89 is composed of two monopolar, magnetic anomalies (M1796 and M1797). M1796 has a low amplitude of 39 gammas and a short duration of 1.1 seconds. M1797 has a high amplitude of 136 gammas and a short duration of 1.1 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #89 is recommended.

Target #90

Target #90 is composed of two monopolar, magnetic anomalies (M1799 and M1800). M1799 has a low amplitude of 38 gammas and a short duration of 1.1 seconds. M1800 has a low amplitude of 31 gammas and a short duration of 1.7 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #90 is recommended.

Target #91

Two magnetic anomalies (M1837 and M1838) represent Target #91. M1837 is monopolar with a low amplitude of 30 gammas and has a short duration of 1.1 seconds. M1838 is dipolar disturbance and has a medium amplitude of 86 gammas with a short duration of 2.2 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #91 is recommended.

Target #92

Target #92 is composed of two monopolar, magnetic anomalies (M1840 and M1841). M1840 has a low amplitude of 43 gammas and a short duration of 1.6 seconds. M1841 has a low amplitude of 28 gammas and a short duration of 2.2 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #92 is recommended.

Target #93

Target #93 is represented by three monopolar, low amplitude, short duration magnetic anomalies (M1875, M1910, and M1911). M1875 is 25 gammas for 2.2 seconds. M1910 is 28 gammas for 3.3 seconds. M1911 is 27 gammas for 1.1 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicated that they represented a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #93 is recommended.

Target #94

Target #94 consists of two magnetic anomalies (M1899 and M1900). M1899 has a low amplitude of 22 gammas with a short duration of 2.8 seconds. M1900 has a low amplitude of 23 gammas with a short duration of 2.7 seconds. Both disturbances are monopolar. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #94 is recommended.

Target #95

Six magnetic anomalies (M1973, M1985, M1986, M1987, M1988, and M1989) comprise Target # 95. Three of the disturbances are dipolar (M1985, M1986, and

M1989) of medium to high amplitudes and short duration. The other three disturbances (M1973, M1987, and M1989) are monopolar of low amplitude and short duration. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #95 is recommended.

Target #96

Target #96 is comprised of five magnetic disturbances (M1974, M2006, M2007, M2008, and M2086). All disturbances are monopolar with low to medium amplitudes and of short duration. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #96 is recommended.

Target #97

Target #97 is made up of three magnetic anomalies (M1977, M1978, and M1979). M1977 is a dipole of low amplitude (45 gammas) and short duration (2.2 seconds). M1978 is monopolar with a low amplitude of 39 gammas and a short duration of 1.1 seconds. M1979 is monopolar with a low amplitude of 48 gammas and short duration of 2.2 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #97 is recommended.

Target #98

Two magnetic anomalies (M1980 and M1981) comprise Target #98. M1980 is a dipole with a medium amplitude of 54 gammas and a short duration of 2.2 seconds. M1981 is a multi-component anomaly with a medium amplitude of 87 gammas and a medium duration of 10.4 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent an area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #98 is recommended.

Target #99

Target #99 is composed of two, medium amplitude magnetic disturbances (M1983 and M1984). M1983 is monopolar with an amplitude of 98 gammas and a short duration of 2.2 seconds. M1984 is a multi-component disturbance with an amplitude of 87 gammas and a short duration of 3.9 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent an area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #99 is recommended.

Target #100

Target #100 consists of two magnetic anomalies (M1992 and M1993). M1992 has a low amplitude of 45 gammas with a short duration of 1.7 seconds. M1993 has a medium amplitude of 68 gammas with a short duration of 1.6 seconds. Both disturbances

are monopolar. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #100 is recommended.

Target #101

Three magnetic disturbance (M1996, M1997, and M2089) comprise Target #101. M1996 is dipolar with a high amplitude of 117 gammas and a short duration of 2.2 seconds. M1997 and M089 are both monopolar anomalies with medium amplitudes of 59 gammas and 70 gammas, respectively. Both have a short duration of 1.1 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #101 is recommended.

Target #102

Target #102 is composed of three magnetic, monopolar anomalies (M1998, M1999, and M2000). M1998 has a low amplitude of 38 gammas and a short duration of 1.1 seconds. M1999 is an anomaly with medium amplitude of 80 gammas and a short duration of 1.7 seconds. M2000 has a low amplitude of 40 gammas and a short duration of 1.0 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #102 is recommended.

Target #103

Target #103 is comprised of two magnetic disturbances (M2001 and M 2002). M2001 has a low amplitude of 47 gammas and a short duration of 1.1 seconds. M2002 has a medium amplitude of 99 gammas and a short duration of 1.2 seconds. Both anomalies are monopolar. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #103 is recommended.

Target #104

Two magnetic anomalies (M2014 and M2015) make up Target #104. M2014 is monopolar with a high an amplitude of 184 gammas and a short duration of 1.1 seconds. M2015 is dipolar with a medium amplitude of 55 gammas and a short duration of 2.8 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #104 is recommended.

Target #105

Target #105 is composed of 5 monopolar, short duration, magnetic disturbances (M2051, M2052, M2053, M2054, and M2055). M2051, M2052, M2053, and M2055 have a duration of 1.6 seconds and M2054 has a duration of 1.1 seconds. M2051, M2052 and M2055 have medium amplitudes of 81, 74, and 63

gammas, respectively. M2053 and M2054 have low amplitudes of 49 and 45 gammas respectively. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #105 is recommended.

Target #106

Target #106 is composed of two dipolar magnetic anomalies (M2060 and M2061) and on monopolar magnetic anomaly (M2062). M2060 has a medium amplitude of 68 gammas with a short duration of 2.1 seconds. M2061 has a medium amplitude of 61 gammas with a short duration of 4.4 seconds. M2062 has a low amplitude of 38 gammas and a short duration of 1.7 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #106 is recommended.

Target #107

Two monopolar magnetic disturbances (M2109 and M2110) make up Target #107. M2109 is an anomaly with a low amplitude of 45 gammas and a short duration of 2.2 seconds. M2110 has a medium amplitude of 64 gammas with a short duration of 1.2 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #107 is recommended.

Target #108

Target #108 is composed of three magnetic anomalies (M2130, M2131, and M2132). M2130 has a medium amplitude of 61 gammas and a short duration of 1.2 seconds. M2131 has a medium amplitude of 76 gammas and a short duration of 1.0 seconds. M2132 has a low amplitude of 49 gammas and a short duration of 1.7 seconds. All three disturbances are monopolar. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #108 is recommended.

Target #109

Target #109 is comprised of five monopolar magnetic disturbances (M2138, M2140, M2141, M2142, and M2143) and one dipolar magnetic disturbance (M2139). All disturbances have a medium-to-high amplitude ranging from 61 gammas (M2142) to 107 gammas (M2139) and a short duration ranging from 1.1 seconds (M2138 and M2143) to 2.7 seconds (M2139). No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #109 is recommended.

Target #110

Four magnetic disturbances (M2175, M2176, M2188, and M2189) make up Target

#110. M2175 and M2176 are monopolar with low amplitudes of 44 and 34 gammas, respectively. Both have a short duration of 1.7 seconds. M2188 is monopolar with a medium amplitude of 67 gammas and a short duration of 1.6 seconds. M2189 is dipolar with a medium amplitude of 64 gammas and a short duration of 4.5 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #110 is recommended.

Target #111

Target #111 is comprised of two magnetic disturbances (M2183 and M2184). Both are monopolar with a short duration of 1.1 seconds and medium or high amplitudes of 64 and 109 gammas respectively. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #111 is recommended.

Target #112

Two monopolar, magnetic anomalies (M2208 and M2209) make up Target #112. M2208 has a medium amplitude of 93 gammas and a short duration of 1.1 seconds. M2209 has a medium amplitude of 67 gammas and a short duration of 1.7 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resources. Analysis of these anomalies indicates that they represent a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #112 is recommended.

Target #113

Target #113 is comprised of three magnetic anomalies (M2216, M2217, and M2218). M2216 has a medium amplitude of 60 gammas and a short duration of 1.1 seconds. M2217 has a medium amplitude of 58 gammas and a short duration of 1.7 seconds. M2218 has a medium amplitude of 57 gammas and a short duration of 1.1 seconds. All three anomalies are monopolar. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #113 is recommended.

Target #114

Three magnetic disturbances (M2229, M2230, and M2231) represent Target #114. M2229 is monopolar with a medium amplitude of 90 gammas and a short duration of 1.6 seconds. M2230 is dipolar with a high amplitude of 108 gammas and a short duration of 3.3 seconds. M2231 is monopolar with an amplitude of 113 gammas and a short duration of 2.2 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #114 is recommended.

Target #115

Target #115 is composed of two monopolar magnetic anomalies (M2233 and M2234). M2233 has a high amplitude of 107 gammas; M2234 has a medium amplitude of 67 gammas. M2233 has a short duration of 1.1 seconds and M2234 has a short duration of 1.6 seconds. There is no acoustic data for this target. These anomalies may be associated with a known abandoned well platform which does not represent a significant submerged cultural resource. Therefore, no further study of Target #115 is recommended.

Target #116

Two magnetic disturbances (M2239 and M2240) represent Target #116. Both anomalies are monopolar with a short duration of 1.1 seconds. M2239 has a medium amplitude of 72 gammas. M2240 has a medium amplitude of 91 gammas. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #116 is recommended.

Target #117

Target #117 is comprised of two magnetic anomalies (M2248 and M2249). M2248 has a high amplitude of 179 gammas and a short duration of 1.1 seconds. M2249 has a medium amplitude of 99 gammas and a short duration of 1.1 seconds. Both anomalies are monopolar. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #117 is recommended.

Target #118

Target #118 is represented by two magnetic anomalies (M2278 and M2279). M2278 is dipolar with a medium amplitude of 63 gammas and a short duration of 2.7 seconds. M2279 is monopolar with a medium amplitude of 57 gammas and a short duration of 1.6 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #118 is recommended.

Target #119

Target #119 is composed of two similar magnetic anomalies (M2289 and M2290). M2289 and M2290 are both, monopolar with a medium amplitude of 60 gammas and have a short duration of 1.1 seconds. No acoustic anomalies are associated with this target. The magnetic attributes of the anomalies comprising this target are not typical of a shipwreck or other potentially significant cultural resource. Analysis of these anomalies indicates that they represent a small area of scattered, and presumably modern, isolated ferrous debris. Based on these data and on the absence of corresponding acoustic returns, no further study of Target #119 is recommended.

CHAPTER VIII

SUMMARY AND RECOMMENDATIONS

This report presents the results of a Phase I Marine Archeological Remote Sensing Survey of the Southwest Pass Ocean Dredged Material Disposal Site (ODMDS) in Plaquemines Parish, Louisiana. R. Christopher Goodwin & Associates, Inc. on behalf of the U.S. Army Corps of Engineers, New Orleans District (USACE-NOD), conducted these investigations in September and October 1999. The study was undertaken to assist the USACE-NOD to satisfy its responsibilities under Section 106 of the National Historic Preservation Act of 1966, as amended, prior to continuing the disposal of dredged material at this location. All aspects of the investigations were completed in accordance with the Scope-of-Work, and the Secretary of the Interior's *Standards and Guidelines for Archeology and Historic Preservation* (Federal Register 48, No 190, 1983). The study area for this project consisted of a single survey block comprising the entire ODMDS, which is located at the southern entrance of the Southwest Pass. The survey block measures a total of 6,652.8 ft (2,027.3 m) x 19,377.6 ft (5,906.4 m).

The primary objectives of this study were to identify specific targets that might represent significant submerged cultural resources within the project area, and provide the USACE-NOD with management recommendations for such resources. These objectives were met with a research design that combined background archival investigations and a marine archeological remote sensing survey.

In the analysis of magnetic data, particular attention was paid to those magnetic anomalies that comprise areas of high density, clusters of anomalies, and single anomalies of unusually high amplitude, duration, or those exhibiting complex magnetic signatures. A total of 2,335 individual magnetic anomalies were identified by this survey. Three hundred of the 2,335 magnetic anomalies were clustered into 119 target groups for further study. These target groups then were individually magnetically contoured for further analysis. The remaining 2,035 anomalies were determined to represent scattered modern ferrous debris.

Additionally, 72 individual acoustic anomalies also were detected during the survey of Southwest Pass ODMDS. Of these acoustic anomalies, 23 correlated with one or more magnetic anomalies. All but five of the 23 acoustic anomalies were judged to be scattered modern debris, and do not represent significant cultural resources. The remaining five acoustic anomalies related directly to four of the 119 magnetic target groups discussed previously. Two of the acoustic anomalies were found to relate to a single magnetic target. Due to the high deposition rate of sediment in the survey area relatively few acoustic anomalies were observed in comparison to the large number of magnetic targets recorded.

Of the 119 magnetic/acoustic target groups, only six are of note. Three of these were determined to be channel marker buoys (targets 1, 5, 8). This was not unexpected as the survey area overlapped into the main shipping channel by several hundred ft. Two of the six targets (Targets 60, 115) lie within a known mapped pipeline and/or cable corridor

and represent structures associated with the petroleum extraction industry. Target #60 is believed to be a pipeline and as such does not represent a significant submerged cultural resource. Target #115 is a magnetic target that is believed to be the signature of an abandoned oil platform that still is visible above the ocean's surface. Therefore, no further study of targets 1, 5, 8, 60, or 115 is recommended.

The two remaining targets of note are Target #13 and Target #37. Target #13 is composed of five magnetic anomalies that occur in an area identified as the location of a charted shipwreck on NOAA Chart 11361. No acoustic data were observed. This likely is due to the very high rate of deposition at the mouth of Southwest Pass, which results in an unusually rapid rate of burial of materials on the channel bottom. Thus, if the magnetic target does represent the shipwreck identified on the NOAA Chart, it currently is deeply buried. The addition of further fill is unlikely to adversely affect this potential resource. No further work is recommended for this target in connection with this undertaking.

The anomalies that compose Target # 37 also may be associated with a charted shipwreck, as indicated by NOAA Chart 11361. As with Target #13, the absence of acoustic data likely results from burial of the resource. The addition of further fill is unlikely to adversely affect this potential resource and no further work is recommended in connection with this undertaking.

The other 114 targets do not display magnetic or acoustic attributes typical of a shipwreck or other potentially significant cultural resource. These targets are classified as small areas of scattered and presumably modern, ferrous debris.

A large number of anomalies were classified as small areas of scattered and presumably modern, isolated ferrous or other debris. This material likely was deposited in the study area over time primarily by two methods. First, the survey area is an Offshore Dredged Material Deposition Site. It is likely that the dredged material deposited in the survey area had moderate amounts of ferrous and other debris mixed in with it. The debris was spread relatively evenly throughout the site over years of dumping. This also may be why the western extreme of the survey area has less debris than the rest of the site, since it may have been outside of the original ODMDS boundaries.

The second, cause for the quantity of debris in the survey area is simply that the survey area lays at the mouth of the Mississippi River. The natural material transport of the Mississippi River has deposited unmeasurable amounts of debris at its various outlets.

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APPENDIX I

SCOPE OF SERVICES

CEMVN-PM-RN 21 May 1999

Scope of Services
Remote Sensing Survey of the Southwest Pass,
Ocean Dredged Material Disposal Site, Louisiana

1. Introduction. This delivery order requires the performance of a remote sensing survey designed to locate submerged cultural resources which may be impacted by disposal of dredged material in the Southwest Pass Ocean Dredged Material Disposal Site (ODMDS). This area is located along coastal Louisiana at the mouth of the Mississippi River at Southwest Pass.

Adverse impacts to cultural resources can result from the disposal of dredged material to any significant cultural resources at the site. Adverse impacts include: 1) increase weight of sediments on any significant shipwreck, and 2) localized burial of possible shipwrecks changing their environment and possibly increasing the rate of decay. While the temporary mounding of dredged material may occur within the disposal sites, the mounds do disperse fairly quickly. The disposed sediments are reworked by waves and littoral currents and are moved out of the ODMDS. The direction and speed of currents are variable, but sediments generally drift toward the west under most circumstances.

2. Background Information. The coastal area of Louisiana has been an important navigation route since prehistoric times. Prehistoric vessels were used in Gulf waters to exploit marine resources. Evidence of this has been uncovered at several archeological sites in the state. In the colonial period, waterborne commerce was associated with French and Spanish trade and transportation routes. Later during the American Period water transportation was related to plantations established along various bayous emptying into the Gulf of Mexico. At present, there are 42 recorded shipwrecks in the coastal waters of Louisiana and numerous wrecks in the rivers and bayous.

The number of recorded shipwrecks represents only a small fraction of the wrecks that are expected to exist in the project vicinity. The project area, as a portion of the Louisiana coastal waters, had the potential to contain colonial era (ca. 1718-1803) shipwrecks. The 1979 discovery of the El Nuevo Constante, a Spanish sailing vessel lost in 1766 in similar waters off the coast of Cameron Parish, amply illustrates this potential. The probability for shipwrecks in the project vicinity increase for nineteenth and twentieth century vessels due to the increased maritime commerce in the region.

A brief navigational history of the coastal water of the Gulf of Mexico and an inventory of known shipwrecks in the study area is provided in the report entitled <u>A History of Waterborne Commerce And Transportation Within the U.S. Army Corps of Engineers, New Orleans District and an Inventory of Known Underwater Cultural Resources</u> prepared by Coastal Environments, Inc. This study documents several shipwrecks in the vicinity of the project area.

Study Area. The study area consists of the designated ODMDS referenced above. The Southwest Pass Ocean Dredged Material Disposal Site is located at the gulfward end of Southwest Pass (Figure 1). The ocean disposal is in an area running approximately 3.67 miles in length and 1.26 miles wide, parallel to the south side of the channel (Figure 2). In 1977, the EPA approved the site for interim use, based on historical use of the site since 1968. In 1980, the interim status of the Southwest Pass Site was extended indefinitely. The exact coordinates as provided by Operations Division are:

28° 54'12"N., 89° 27' 15"W.
28° 54'12"N., 89° 26' 00"W.
28° 51'00"N., 89° 27' 15"W.
28° 51'00"N., 89° 26' 00"W.

4. General Nature of the Work. The purpose of this study is to locate and identify historic shipwrecks in the above noted project area. The study will employ a systematic magnetometer and side scan sonar survey of the study area using precise navigation control and a fathometer to record bathymetric data. All potentially significant anomalies will be briefly investigated via additional intensive survey and probing of the water bottom (if possible). No diving will be performed under this delivery order.

The project requires historic background research, followed by the intensive survey of the proposed ODMDS area. An inventory of all magnetic, sonar, and bathymetric anomalies will be prepared. The background research, field survey, and data analyses will be documented in a brief management summary and comprehensive technical report.

5. Study Requirements. The study will be conducted utilizing current professional standards and guidelines, including, but not limited to:

the National Park Service's National Register Bulletin entitled "How to Apply the National Register Criteria for Evaluation";

the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation as published in the Federal Register on September 29, 1983;

Louisiana's Comprehensive Archeological Plan dated October 1, 1983;

the Advisory Council on Historic Preservation's regulation 36 CFR Part 800 entitled, "Protection of Historic Properties" and

the Louisiana Submerged Cultural Resources Management Plan published by the Louisiana Division of Archaeology in 1990.

The study will be conducted in three phases: review of background sources, remote sensing survey, and data analyses and report preparation.

Phase 1. Review of Background Sources. Due to the availability of the study referenced in Section 2 above, this phase is limited to a brief review of pertinent information contained in the referenced CEI report, Chief of Engineers reports, and general histories of the parishes covering the project.

In addition to reviewing the cultural background of the project area, geological and sedimentological studies will be examined to develop a concise summary of the physical environment of the project areas. This investigation specifically will examine issues relating to wreck dispersion and preservation as well as channel changes.

Phase 2a. Remote Sensing Survey. Upon completion of Phase 1, the contractor shall proceed with execution of the fieldwork. The equipment array required for this survey effort is:

(1) a marine magnetometer;
(2) a differential GPS positioning system;
(3) a recording fathometer;
(4) a side scan sonar system.

The Contracting firm may propose additional equipment such as sub-bottom profiler and so forth as long as they can provide information in the technical proposal as to what kind of additional data would be obtained from its use. Three estimates must be provided if the contractor does not own the equipment to be used.

The following requirements apply to the survey:

(1) transect lane spacing will be no more than 150 feet;
(2) positioning control points will be obtained at least every 100 feet along transects;

(3) background noise will not exceed +/- 3 gammas;
(4) magnetic data will be recorded on 100 gamma scale;
(5) the magnetometer sensor will be towed a minimum of 2.5 times the length of the boat or projected in front of the survey vessel to avoid noise from the survey vessel;
(6) the survey will utilize the Louisiana Coordinate System.

Phase 2b. Definition of Anomalies. Additional, more tightly spaced transects will be conducted over all potentially significant anomalies to provide more detail on site configuration and complexity. Probing of the water bottom will be performed at all potentially significant anomalies where water depths and weather conditions permit.

Phase 3: Data Analyses and Report Preparation. All data will be analyzed using currently acceptable scientific methodology. The post-survey data analyses and report presentation will include as a minimum:

(1) Post-plots of survey transects, data points and bathymetry;
(2) same as above with magnetic data included;
(3) plan views of all potentially significant anomalies showing transects, data points, magnetic and depth contours;
(4) correlation of magnetic, sonar and fathometer data, where appropriate; and
(5) high quality reproduction of sonar records related to potentially significant anomalies.

The interpretation of identified magnetic anomalies will rely on expectations of the character (i.e. signature) of shipwreck magnetics derived from the available literature. Interpretation of anomalies will also consider probable post-depositional impacts, and the potential for natural and modern, i.e. insignificant sources of anomalies.

The report shall contain an inventory of all magnetic, sonar, and bathymetric anomalies recorded during the underwater survey, with recommendations for further identification and evaluation procedures when appropriate. These discussions must include justifications for the selection of specific targets for further evaluation. Equipment and methodology to be employed in evaluation studies must be discussed in detail.

A product to be provided under this delivery order and submitted with the draft reports will include CAD graphics and/or design files compatible with the NOD Intergraph system. The maps and supporting files generated from marine survey data will show,

at a minimum, the survey coverage area, the locations of all anomalies and other pertinent features such as: channel beacons and buoys, channel alignments, bridges, cables and pipeline crossings. Tables listing all magnetic anomalies recorded during the survey will accompany the maps. At a minimum, the tables will include the following information: Project Name; Survey Segment/Area; Magnetic Target Number; Gammas Intensity; Target Coordinates (Louisiana State Plane).

If determined necessary by the COR, the final report will not include detailed site location descriptions, state plane or UTM coordinates. The decision on whether to remove such data from the final report will be based upon the results of the survey. If removed from the final report, such data will be provided in a separate appendix. The analyses will be fully documented. Methodologies and assumptions employed will be explained and justified. Inferential statements and conclusions will be supported by statistics where possible. Additional requirements for the draft report are contained in Section 6 of this Scope of Services.

6. Reports.

Management Summary. Three copies of a brief management summary, which presents the results of the fieldwork, will be submitted to the COTR within 1 week of completion of the survey area. The report will include a brief summary of the historical research and field survey methods by waterway, as well as descriptions of each anomaly located during the survey. Recommendations for further identification and evaluation procedures will be provided if appropriate. A preliminary map will be included showing the locations of each anomaly. A summary table listing all anomalies will be included with the maps. The table will include the following information: Project Name; Survey Segment/Area; Magnetic target number; Gammas Intensity; Target Coordinates (Louisiana State Plane).

Draft and Final Reports (Phase 1-3). Four copies of the draft report integrating all phases of this investigation will be submitted to the COR for review and comment within 20 weeks after work item award. The digitized project maps will also be submitted with the draft report.

The written report shall follow the format set forth in MIL-STD-847A with the following exceptions: (1) separate, soft, durable, wrap-around covers will be used instead of self covers; (2) page size shall be 8 1/2 x 11 inches with 1-inch margins; (3) the reference format of American Antiquity will be used. Spelling shall be in accordance with the U.S. Government Printing Office Style Manual dated January 1973.

The COR will provide all review comments to the Contractor

within 4 weeks after receipt of the draft reports (20 weeks after work item award). Upon receipt of the review comments on the draft report, the Contractor shall incorporate or resolve all comments and submit one preliminary copy of the final report to the COR within 3 weeks (23 weeks after work item award). Upon approval of the preliminary final report by the COR, the Contractor will submit one reproducible master copy, one copy on floppy diskette, one copy on CD-ROM containing report in .pdf format, and 40 copies of the final report to the COR within 26 weeks after work item award.

APPENDIX II

RESUMES OF KEY PROJECT PERSONNEL

CHRISTOPHER R. POLGLASE, M.A., A.B.D.
VICE PRESIDENT- ARCHEOLOGICAL SERVICES

Mr. Christopher Polglase received his baccalaureate degree from William and Mary in 1980, his M.A. from SUNY Binghamton in 1985, and he currently is A.B.D. at that institution. At SUNY Binghamton, Mr. Polglase served as a teaching, research, and graduate assistant, where he edited the multi-volume report on excavations at the Utqiagvik site in Barrow, Alaska. Mr. Polglase received considerable cultural resource experience at SUNY Binghamton, where he served as crew chief on Phase I-III projects. Mr. Polglase also served as crew chief for three seasons at Fort Christanna, an early eighteenth century frontier outpost, and as field supervisor for the survey of the proposed Roanoke River Parkway. He also has participated in large projects in Alaska and throughout Italy.

At Goodwin & Associates, Inc., Mr. Polglase has worked on numerous projects in the Middle Atlantic, Southeast, Mid-West and the Caribbean. He has directed data recovery at numerous prehistoric and historic sites in the Middle Atlantic and Phase I-II studies across the Eastern United States. Two of those projects, excavations at the Russett Center and at the Garman Site, received the Excellence in Archeology Awards from the Anne Arundel County Trust for Historic Preservation in 1991 and 1992. His projects also received awards from the Maryland Historical Trust for Education Excellence (1997) and from the Harford County Historic Preservation Commission for the Preservation Project of the Year (1999).

Mr. Polglase's experience at Goodwin & Associates, Inc. has encompassed the range of preservation planning and interpretation studies. He has directed the preparation of multi-disciplinary cultural resource planning studies for the Army Corps of Engineers, NAVFACENGCOM, the Department of Energy, and the Maryland Port Administration. These projects have included numerous Cultural Resource Management Plans (ICRMP) for such diverse facilities as the U.S. Naval Academy, Aberdeen Proving Ground, and Fort Belvoir. He has overseen the design of exhibits at several DoD installations, including preparation of panels, exhibit cases, and a touch screen computer kiosk. The development of that kiosk and subsequent projects led to an interest in the digital interpretation of archeological and historical resources, including 3D modeling of archeological sites. Mr. Polglase has directed the preparation of Geographic Information System (GIS) deliverables to DoD and private sector clients in the Middle Atlantic, including: (1) complete historic and natural resource data layers for 11 U.S. Navy installations in Tidewater Virginia; and (2) archeological and historical data for 29 counties in Pennsylvania. Mr. Polglase also oversees artifact curation compliance and conservation studies for Goodwin & Associates, Inc., including NAGPRA research for the U.S. Army Corps of Engineers in 21 states.

His research interests include lithic analysis, long-distance exchange, and the development of holistic preservation planning studies. In addition to numerous technical reports, he has published papers in the *Journal of Archeological Science*, *Preistoria Alpina*, and the *Journal of Middle Atlantic Archaeology*. He has presented professional papers to the Society for American Archeology, the Middle Atlantic Archeological Conference, the Archeological Societies of Maryland and Virginia, the Eastern States Archeological Federation, the Center for Medieval and Early Renaissance Studies, and the Valle dei Cavalieri.

JEAN B. PELLETIER, M.A.
NAUTICAL ARCHAEOLOGIST/REMOTE SENSING SPECIALIST

Jean B. Pelletier, M.A., graduated from the University of Maine in 1991 with a Bachelors degree in Geological Sciences, and received a Master of Arts degree in History from the University of Maine in 1998. His research interests include maritime history and nautical archaeology, steamboat technology, industrial technology, remote sensing, geophysics, scientific diving technology, and underwater photography/videography. Mr. Pelletier has formal training in marine geophysics, marine and terrestrial remote sensing, remotely operated vehicles, underwater video and diving safety, and has conducted archaeological, archival, and geophysical investigations in Alabama, Connecticut, Delaware, District of Colombia, Florida, Georgia, Illinois, Louisiana, Maine, Maryland, Massachusetts, Mississippi, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, South Carolina, and Virginia. As a graduate student at the University of Maine, Mr. Pelletier worked with Dr. Warren C. Riess as a research assistant on the Penobscot Expedition Phase II, conducting remote sensing and underwater documentation of the ships of the Penobscot Expedition.

Before joining Goodwin and Associates Inc., in 1997, Mr. Pelletier served as an archeological and scientific diving consultant for several universities and public utility companies along the Atlantic seashore. In this capacity, Mr. Pelletier managed the recovery of nine cannons from the *Nottingham Galley*, an eighteenth century English merchant ship lost on the ledges of Boon Island, Maine.

Since joining Goodwin & Associates Inc., Mr. Pelletier has been involved in numerous Phase I, II, and III archaeological investigations of underwater sites. He has conducted remote sensing surveys in the Puerto Rico, Gulf of Mexico, Chesapeake Bay, and a Phase III recordation of the steamboat *Kentucky*, a confederate troop-transport lost on the Red River in 1865, near Shreveport, Louisiana. Mr. Pelletier's professional affiliations include: American Academy of Underwater Sciences, Marine Archaeology and Historical Research Institute (MAHRI), and the Society for Historical Archaeology.

Larkin A. Post, B.A.
Nautical Archeologist/Dive Safety Officer

Larkin A. Post graduated from the University of Maine in 1995 with a double major in anthropology and history. He attended the Maritime History and Nautical Archaeology program at East Carolina University (ECU). At that institution organized and led the largest student project in the program's history, for which work he should receive his M.A. in late 1999. Mr. Post is also a fully certified NAUI scuba instructor, ASHI first aid & CPR instructor, and American Red Cross Water Safety Instructor. As Goodwin and Associate's Dive Safety Officer (DSO) Mr. Post is responsible for all dive operations of the company and maintain Goodwin's status as currently the only private company that is a member of the prestigious American Academy of Underwater Sciences.

Mr. Post grew up working on the family's coastal Maine island and worked on local fishing boats from a young age. In spite of this he still retains a research interests in nautical archaeology, naval history and maritime industrial technology. Professional interests include remote sensing, navigation, remote piloted vehicle operation, and technical scuba diving. These skills have allowed Mr. Post to work on Phase I, II, III maritime archaeological projects in Maine, Massachusetts, Maryland, North Carolina, Bermuda, and Louisiana.

Before joining Goodwin and Associates, Mr. Post served as remote sensing and boat specialist for ECU. He also helped teach classes in remote sensing and was in charge of logistical setup and day to day operation several of the university's maritime projects. Finally for ECU he served as crew chief of the Castle Island, NC field school and as interim DSO for the project.

Sarah A. Milstead Post
Nautical Archaeologist / Scientific Diver/ Assistant Conservator

Sarah Milstead Post graduated from the University of Texas at Austin in 1995 with a Bachelors degree in Archaeology. Mrs. Post will be receiving a Masters of Arts degree in Maritime History and Nautical Archaeology from East Carolina University in 2000. Her experience and education in nautical archaeology has led to interests in remote sensing, scientific diving, ship construction, maritime history, cultural resource management, and conservation. She has formal training in all of these areas and has been involved with projects in Texas, Louisiana, North Carolina, Virginia, Bermuda, Belize, and Maine. As an undergraduate, Ms. Post worked as an intern for Barto Arnold at the Texas Historical Commission (THC) dealing with all phases of underwater archaeology. She was also on the team of nautical archaeologists with the THC in 1995 that discovered the *La Belle Wreck* that dates to the seventeenth century.

Before joining Goodwin and Associates Inc. in 1999, Mrs. Post was a crew chief for field schools at East Carolina University while also finishing classes for her Masters degree. She has worked on many nineteenth century sites mapping, excavating, and conserving artifacts from shipwrecks. Since joining Goodwin & Associates Inc., Mrs. Post has conducted Phase I marine remote sensing surveys in Louisiana and Virginia, and Phase II underwater surveys dealing with historic and prehistoric surfaces in Louisiana, Alabama, Florida, Virginia, and Maryland. She has also conserved many land and underwater artifacts dating from the seventeenth century to the nineteenth century. Mrs. Post's professional affiliations include: the Society of Historical Archaeology and American Academy of Underwater Sciences.

Douglas S. Jones, B.S.

Nautical Archeologist

Douglas S. Jones graduated from Virginia Tech in 1996 with a Bachelor of Science degree in Biology. Mr. Jones is currently working towards a Master of Arts degree in Maritime History and Nautical Archaeology at East Carolina University (ECU). During Mr. Jones' career he has been involved with projects in North Carolina, Bermuda, Louisiana, and New York, and his academic and professional experiences have led to interests in ship construction, conservation of maritime artifacts, remote sensing, and scientific diving.

Prior to joining R. Christopher Goodwin and Associates, Inc., Mr. Jones had worked on projects involving wrecks dating back to the eighteenth century, including the wreck of the alleged *Queen Anne's Revenge,* which Mr. Jones had the opportunity to work on while he was an intern with the North Carolina State Underwater Archaeology Unit in 1999. While completing his course work at ECU, Mr. Jones will be conducting his Master's thesis research on the history and nautical archaeology of the *Black Warrior,* a Confederate schooner that was sunk during the battle of Elizabeth City in 1862. The results of this thesis research will be completed in 2000.

Along with being a trained nautical archaeologist and conservator, Mr. Jones is also an American Academy of Underwater Sciences (AAUS) certified diver, and he hopes to utilize these skills for a career in nautical archaeology, focusing on nineteenth century ship construction, and Civil War naval history.

APPENDIX III

TABLES

Table 1. Previously Completed Cultural Resources Surveys Located Within 6.4 km (4 mi) of the Proposed Project Area

Field Date	Report Number	Title/Author	Investigation Methods	Results And Recommendations
1983	22-1022	*Deep Draft Report: A Survey of the Underwater Portions of the Baton Rouge to the Gulf, Deep Draft Access Project. Venice to the Gulf Segment, Including Supplement II to the Mississippi River, Baton Rouge to the Gulf EIS* (Muller 1985)	Remote sensing (magnetometer and side scan sonar)	Identified a total of 144 magnetic anomalies, 33 of which were assessed as potentially significant. Additional testing of these anomalies was recommended.
2000	22-2269	*Phase I Marine Archeological Remote Sensing Survey of Segments Along the Southwest Pass of the Mississippi River, Plaquemines Parish, Louisiana* (Goodwin et al. 2000)	Remote sensing (magnetometer and side scan sonar	Identified 128 magnetic anomalies and four acoustic disturbances. All of these were assessed as not significant and no additional testing was recommended.

Table 2. Principal Import and Export Commodities Port of New Orleans, 1914-1944

(sources: Davis 1915, McChesney 1920, Board of Commissioners 1925, Parker 1924, Board of Engineers 1944)

Year/ Products	1914		1920		1923		1924		1944	
	Export	Import	Export	Import	Export	Import	Export	Import	Export	Import
Food & consumables	wheat, tobacco	coffee, sugar, bananas	grain	coffee	wheat, flour, tobacco	coffee, sugar, bananas	sugar, molasses, rice, salt		fish, mollasses, cattle, grain	tropical fruit, vegetable oils (coconut, palm, olive)
Chemicals		kainit, fertilizers	creosote, crude oil	pyrites, nitrates	various, mineral oil	nitrates, mineral oil	creosote, crude oil, sulfur, gas, coal tar, lime stone, gypsum, waste for paper pulp	various	petroleum products, bauxite, linseed oil, neat's foot oil	
Materials	cotton, cotton seed, meal, and cake, lumber	burlap, sisal			all wood, cotton	mahogany	hardwoods, pine	hardwoods		
Manufactured goods	staves		steel		machinery		wood working plants			

Table 3. Ship Types in the Northern Gulf of Mexico 1500-1980

(sources: Wilson 1983, Garrison *et al.* 1989)

Rig	Used By	Purpose	Propulsion	Size (Approx.)	Notes
1500-1699					
bark (barque)	French		square, rectangular sails; 3 masts	100' long; 370 tons	prevalent after 1585
bateau ("boat")	French		some had square sails; 1 mast; rowed or poled	18-85' long	flat bottom; developed into dory
bilander	French		square sails; 2 masts	100-150' long	
biscayan	French		sails; 2 masts		longboat or chaloupe
brigantine	French Spanish British		square sails; 2 masts		Span. b. equivalent to British pennace
bullboats	French				canoe made of hides
caiche	French		sails; 2 masts		Eng. "ketch"; name changed to "schooner" in 1700s
canoe	French			12-36' long; open	made of wood, hides, or dugouts
canots maitres (grand canots, piroques)	French	exploration, trade	some had sails	up to 50' long; open	
caravel	Spanish	exploration, trade	lateen sails; 3-4 masts	10-50 tons	used from 1500 to 1650, replaced by navios and larger galleons
carrack	Spanish	warship, merchant	sails; up to 3-4 masts	150-1500 tons	cannon plus infantry weapons
chaloupe	French	exploration, trade	sails; 2 masts	18-28' long	Eng. "shallop", Span. "lancha", "longboat"
corvette (sloop of war)	French	warship	square sails; 3 masts		not sloop rigged; used more by Fr. and Amer. than Brit.; smaller than frigate
felucca (felouqe)	French	warship	lateen sails; rowboat	100' long; 370 tons	
flatboat (bateau plat, radeau	French		square sails; 1-2 masts; poled		used on rivers or protected waters; similar to Amer. "scow" and "gondalow" or "gundalow"
flyboat (filibote, fluyt, flute)	Spanish	cargo	square and lateen sails; 2 masts	180-400 tons; 90-140' long	used regularly in trade from 1580 to 1640
frigate (fregate, =Span. fragata)	French	warship		small, fast	carried messages; equi. to Brit. "Sixth Rate Ship"; popular from 1575 to 1645 in Spanish trade
galleon	Spanish	warship, armed merchant	lateen sails; 3-4 masts	100-200' long	with naos, dominated Sp. trade after 1520s
galley	Spanish	warship (coastal defense)	sail-oar hybrid; lateen sails	60' long	later designs in Gulf and SE had 14 oars, 18 cannons
hooker, hourque	Spanish	supply, cargo		small, medium	infrequent from 1550 to 1650
ketch (catch, caiche(?))	French		sails; 2 masts	70-130' long	foremast taller than main mast
launch (=Span. lancha)	French		sails; rowed	small; open	name "launch" replaced "shallop" and "longboat" after 1740s
longboat (chaloupe)	French		sails; 2 masts; rowing	52' long	a ship's boat
nao	Spanish		sails; 2 masts	150-1500 tons	similar to carrack, but no foremast
pinnace	French		various types of sails; rowed	30-50' long	similar to but larger than launch or longboat
piroque	French		rowed	25-30' long; open	dugout

Rig	Used By	Purpose	Propulsion	Size (Approx.)	Notes
traversier (smack)	French	freight, general purpose			
radeau	French	freight, general purpose			similar to flatboat
skiff		ship's boat		20' long	smallest of ship's boats
1700-1800					
balandra	Spanish		square sails; 2 masts	100-150' feet	Span. name for "bilander" (?)
bateau	English-American		some had square sails; 1 mast	40-85' long	flat-bottomed
bercha	Spanish			small	in use in 1780s
bergantine	Spanish		often lateen sails	small; open	of shallop or pinnace type
brig	English-American	sometimes for slaving	square sails; 2 masts	medium	abbreviation of "brigantine"
canoe	English-American			12-36' long; open	made of wood, hides, or dugouts
cutter (gig)	English-American	smuggling; law enforcement	sails; 2-3 masts	20-28' long	like "cutter" in late 1700s
dory	English-American		sails; rowed	16-20' long	may have developed from "bateau"
flat	English-American		rowed		used in sheltered waters
fragata (frigate)	Spanish	warship	sails	small, fast	carried armament on upper decks; carried messages; equi. to Brit. "Sixth Rate Ship"
galley	Spanish	warship, armed merchantman	sails; 3-4 masts	100-200' long; 60-70 guns, 600 men	
galliott (galeotta)	Spanish	warship	lateen sails; 16-20 oars		small galley
goleta	Spanish	mail; messenger	square and lateen sails; 2 masts	70' long	similar to schooner
gondalow (gundalow, gondola)	English-American	cargo	sails; poled		flat-bottomed; for rivers, lakes, bays; equi. to scow, flat, radeau
guairo	Spanish	mail; messenger	lateen sails; 1-2 masts(?)		similar to goleta (?)
Moses boat	English-American	lighter (for casks, hogsheads)	rowed	14-17' long; open	still in use in West Indies
navio	Spanish	warship	sails	60-70 guns; 500-600 men	
paquebot	Spanish	pack; transport	sails	18 guns; 140 men	
paranzello	Spanish		lateen sails; 1 mast		evolved into New Orleans lugger
periaqua	English-American		sails		used in West Indies
pink	Spanish		sails	small	rigged like a sloop, brigantine, ship, schooner; any small sharp-sterned vessel in 19th c.
polacre	Spanish		square plus lateen sails; 2-3 masts		
punt	English-American		rowed	20' long	flat-bottomed; common in 18th c.; form of scow
setia	Spanish		lateen sails; 2 masts		
schooner	English-American	various	gaff sails; 2-7 masts (majority: 2 masts)	30-375' long (majority: 60-120')	by 1790, national rig os U.S. and Canada
scow	English-American				flatboat; name appeared in 1800s

Rig	Used By	Purpose	Propulsion	Size (Approx.)	Notes
shallop (chaloupe)	English-American				replaced in late 18th c. by names: "longboat", then "launch"
ship	Spanish	warship, merchantman	square sails; 3+ masts	large	
skiff	English-American	gen. purpose	sails; rowed		flat or round bottom
sloop	English-American	warship; cargo	gaff sail; 1 mast; stay sail; 1-2 jibs	corvette size	
snow			identical to brig	100-150' long	
tender	Spanish	supply(?)	sails		
transport		gen. purpose(?)	sails	medium-large	
whaleboat	English-American	whaling; mail; light freight; passenger; privateers	sails	20-24' long	
wherry	English-American	passenger	rowed		
yawl	English-American		rowed; some sails; 1-2 masts	15-23' long	appeared approx. 1706
1800-1900					
Baltimore clipper	American	coastal trading; slaving	brig, brigantine, ship rigs used	90-120' long	developed about 1780; became model for coastal trading vessels (80' long max.)
bark (barque)		cargo	square sails; 3-5 masts (3 mast common)	102-155' long	late 1800s to after WWI; 3 mast common on European vessels in Gulf)
barkentine			square, fore-&-aft sails; 3-6 masts	medium-large	late 1800s to after WWI
bateau				20' long	New England dory type in Gulf from ca. 1875 to 1970; flat-bottomed
Bermuda sloop	American	various	square, gaff sails	66' long	West Indies-Bermuda sloop built in Chesapeake ca. 1740; sloop modified to schooner, then to Baltimore clipper
Biloxi schooner	American		sails; 2 masts	40' long; barge-like; after 1893--50-65' long;	prob. Introduced from Atlantic ports, modified locally; flat bottom, shallow draft
Biloxi/New Orleans lugger	American	trade (fish, oyster, fruit, dominated by Spanish and Italians)	dipping lug sail; 1 mast	34' long	built in Mississippi
brig	American		various plans of square and fore-&-aft sails; 2 masts	medium	various hull forms: 2-mast schooner (1820-1850), clipper (1840-1850); not popular by late 1800s; fore-&-aft sail on foremast produced "brig schooner" or hermaphrodite brig"
catboat	American	fishing, recreation	sails		popular on Atlantic and in Gulf
cutter	American	Coast Guard	sails; 1 mast; steam		
dory (=bateau)	American				introduced into Gulf by New England snapper fishermen in 1875
flattie	American		sloop rigged	17' long	flat-bottomed; outboard rudder
gundalow (=scow)	American	freight	sloop or schooner rigged	25-35' long	popular on western Gulf after 1840
hermaphrodite brig (=brig)	American		variation on brig sail plan		
ketch	American		sails; 2 masts	small-medium	
Key West smackee	American	fishing	sloop rigged	17-26' long	outboard rudder

Rig	Used By	Purpose	Propulsion	Size (Approx.)	Notes
Louisiana oyster sloop	American	oyster	sloop rigged	36' long	used at Morgan City, Louisiana and possibly E of Mobile
packet	American	freight; passenger	sails; steam		Gulf vessel from ca. 1820 to 1927
pilot boat	American	meet incoming vessels	sloop or schooner rigged; raked masts	75' long	modified Chesapeake form used in Gulf in late 1800s
pinky	American	fishing	gaff sails; 2 masts	50' long	popular in New Englans, may have been used in Gulf
piroque	American	fishing, marsh hunting	rowed	10-12' long	in use from Colonial to present
river yawl boat (=river skiff)	American		rowed	18-24' long	in use ca. 1850 to 1925; flat-bottomed
schooner (=Biloxi schooner)	American	oyster dredging, special fisheries, recreation	2 masts	40' long	barge-like; after 1893--50-65' long
scow (=gundalow)	American		schooner rigged	25-35' long	used on south Atlantic rivers and western Gulf
shallop (chaloupe)	American		sails; 2 masts		ca. 1800-1940 were designed for sailing
sharpie	American		various sail plans: cat, sloop, schooner, yawl, cat-ketch	20-65' long	originally flat-bottomed; used for sailing from New England to Gulf
ship	American	deep water bulk carrier	sails; 3-5 masts		5 masts and steel hulls in late 1800s to early 1900s
skiff	American		sails; rowed	12-24' long	used in inshore waters; open or partly decked
skipjack	American		cat, lug sails; sloop rigged	20-25' long	developed in Rhode Island/Massachusetts ca. 1860, built on Gulf ca. 1886
sloop	American	fishing; freight	sails; 1 mast		in late 1800s, often used as yachts
smack (=well smack)	American	fishing	sloop or schooner rigged	various	has a live-well, or waterfilled tank
snow (=brig)	American		fore-&-aft sails; 2 masts		
steamer	American	passenger; towing; freight	steam	30-70' long	various types used from 1820s on river and bays of northern Gulf coast
steamboat, sidewheel padle	American	riverine packet	high pressure steam engine driving two side paddles		common in mid-late 19th c. coastal trade
steamboat, sternwheel	American	riverine packet	high pressure steam engine driving sternwheel		supplanted sidewheel; used on bayous, canals, along coast
steamship, paddle	American	deep water cargo	low pressure steam engine		deep draft; iron and steel supplanted wood hulss in late 19th c.
well smack (=smack)	American	fishing	sloop or schooner rigged	various	has a live-well, or waterfilled tank
whitehall	American	harbor boat (for pilots, reporters, runner, brokers, etc.)	rowed	17-20' long	originated in New York in 1820s; used in Mobile
yawl	American	recreational since 1870s	rowed; fore-&-aft sails; 1-2 masts	15-23' long	
yawl-boat	American	gen. ship use, fishing, light freight from ca. 1850 to 1900	spirit, gaff sails; 1 mast	16-20' long	
1900-1980					
bark	American	deep water freight	square sails; 3-5 masts		deep water freighters used into 1920s

Rig	Used By	Purpose	Propulsion	Size (Approx.)	Notes
barkentine	American	freight	square sails; 3-6 masts	280' long	some built by Italian firm in Pascagoula
bay shrimper	American	shrimp, oysters	engine	35' long	inshore shrimper developed ca 1915 to 1925
bay steamers	American	ferry	sidewheeler engine		
Biloxi lugger	American	shrimp, oysters	engine	40' long	inshore vessels
Biloxi schooner	American	oyster dredging, deep water shrimping	engine	60-70' long	built on Mississippi coast until ca. 1933; nearly flat-bottomed
catboat	American	recreation, fishing	sails	24' long	
cat-rigged skiff	American	recreation, fishing	gaffor sprit sails; 1 mast	14' long	flat-bottomed; open
charter boat	American	sport fishing	engine	24-35' long	in use since ca. 1920; locally built were of wood; commercially built of fiberglass
crewboat	American	transport in offshore petroleum industry	engine		steel or aluminum monohull
dory	American	life boat	sails		
gulf shrimper	American	offshore shrimp trawler	engine	70-100' long	developed after 1937
Lafitte skiff	American	all-purpose, inshore, shallow water	engine	30-34' long	developed in Lafitte, Louisiana, between 1936 to 1946
mullet skiff	American	net fishing	outboard motor	16' long	commercially built, wooden, flat-bottomed
oyster skiff	American	oysters	outboard motor	18-25' long	flat-bottomed
snapper boat (=schooner)	American	offshore line fishing (deep water bottom or snapper fishing)	engine		schooners without sails and masts, refitted with engines
sport fisherman (=charter boat)	American				
steamship, screw propellor	American	deep water cargo	steam engine	350' long	supplanted paddle design; used through WWII
supplyboat, mudboat	American	serve offshore oil industry	diesel		design of Gulf origin
submarine, U-boat	German	warship	diesel		operated in Gulf from 1942 to 1944
tanker	various	petroleum	diesel		steamers began to carry petroleum in 1880s; became principal targets of U-boats
tugboat, towboat	American	tow boats, push boats	engine	55' long	early 20th c. tugs were narrow; later became barge towboats to push boats or dock vessels
whitehall	American		rowed		

Table 4. Confederate States Navigational Obstruction Types Mobile Bay, Alabama

(source: Irion 1985, 1986)

Obstruction Type	Materials	Intent of Obstruction	Location
sunken vessels	loaded with brick	blockade channel	employed in shoal waters like bays
sunken hulks	vessels	blockade waterway	generally employed
wreck stakes	wood	part of sunken vessel obstructions	primarily by Mobile City
booms: chain and cypress raft; crib-work; logs; ropes	iron, wood, stone, fibers	blockade channel	between Forts Morgan and Gaines
elongated mound	handmade bricks	blockade river	mouth of Mobile River
piles	wood	blockade waterway	by spits and shoals
main & floating batteries	some plated with railroad iron	cover pilings and sunken hulks	
floating mines		sink vessels	generally employed

Table 5. Examples of Vessels Grounded or Lost in the Vicinity of the Mouth of Southwest Pass (1892 to 1898)

(Source: *US Congress Document No. 142*, 1899)

Date of Incident	Vessel Name	Vessel Type	Disposition	Location
1892	*Charles Luling*	bark	filled with water; lost	900 ft beyond W jetty
1892	*Barbarian*	steamship	grounded 2 days	at channel entrance
1892	*Traveler*	steamship	grounded thrice; pulled off by tugs	at head & entrance of pass
1892	*Akalba*	steamship	grounded for 36 hrs	900 ft beyond entrance
1892	*Dunkeld*	steamship	grounded on lump for 1 day	at head of pass
1894	*Loango*	steamship	grounded for 36 hrs; pulled off by tug	800 ft of W end of jetties
1894	*Darlington*	steamship	grounded for 12 hrs	W of jetties
1895	*Marie Vizen*	bark	struck lump; sank and abandoned	1,500 ft S of W jetty light
1896	*Alberta*	steamship	grounded for 4 days and 5 hrs	W side of jetties by west light
1896	*Jerome*	steamship	grounded for 24 hrs	2 mi below head of pass
1897	*Louisiana*	steamship	grounded 60 hrs; pulled off by tugs	1,000 ft beyond end of W jetty
1897	*Princepessa Christiana*	steamship	grounded for 17 hrs	entering the jetties
1897	*Gottfried Schenker*	steamship	grounded twice on shoal for 3 days; jettisoned cargo; pulled off by tugs	entering the jetties
1898	*Breakwater*	steamship	sheered across mouth of channel and hit jetty; stranded 3 days	landed on top of W jetty

Table 6. Shipwrecks in the Vicinity of Southwest Pass

(sources: **AWOIS**: *Automated Wreck & Obstruction Information System*, 1999.
B: Berman, Bruce D., *Encyclopedia of American Shipwrecks*, 1972.
HO: Hydrographic Office, U.S. Navy, *Wreck Information List*, 1945.
LH: C. Bradford Mitchell, "The Lytle-Holdcamper List," 1975.
NM: *Notices to Mariners*, Hydrographic Office.
Navy: U.S. Navy, National Image and Mapping Agency, 1999.
USCGS: United States Coastal and Georgraphic Service; wreck chart no. 1007-A, 1947.

Vessel/ Obstruction Name	Record No.	Vessel/ Obstruction Type	Year Built	Place Built	Tons	Dimensions	Date Lost or Reported	Cause	Location	Disposition	Notes: Sources
BB 5		barge	1932		964		12/17/63	foundered	at mile 24.9 AHP		at Cable Crossing, Buras, LA [B]
Blue Water I		barge	1957		641		10/6/64	storm	in W Delta Block 104		[B]
R.O. 2	Naval: 32112	barge					2/20/65	marine casualty	**28-54-00N, 89-27-00W**		[Navy]
R.O. 2	Naval: 32615	barge					7/1/67		**28-53-58N, 89-27-06W**		[Navy]
R.O. 2	32,767	barge					4/20/68		**28-54-01N, 89-27-09W**		[Navy]
Maverick		barge	1964		2,995			hurricane	in Miss. River Delta	[B]	
unknown	AWOIS: 296 Naval: 36,473	barge						sunk by marine casualty	**28-54-40.85N, 89-25-36.17W** (pos. approx. to 1 mi)		[NM], [AWOIS]
G.R. Co. 4		barge; steel	1937		117		2/21/12	foundered	at Buras, LA		[B]
obstruction	AWOIS; 8374	buoy sinkers, chain				two 20,000 lb sinkers; 65 ft chain	00/00/1986	discontinu-ance of lighted buoy	NE of proj. area at: **28-54-17.5N, 89-25-46W** (pos. approx.)	abandoned	[AWOIS]
Harry of the West		clipper	1855		1,050		11/1865	burned	near mouth of Miss. River		[B]
Governor Morton		clipper	1851		1,430	length: 196 ft	7/2/1877	burned	at mouth of Miss. River		carried cotton cargo [B]

Vessel/ Obstruction Name	Record No.	Vessel/ Obstruction Type	Year Built	Place Built	Tons	Dimensions	Date Lost or Reported	Cause	Location	Disposition	Notes: Sources
Bonus Kin	AWOIS: 8371	fishing vessel				73 ft long	0/0/1967	sunk	at left descending side of SW Pass inside dike mile 19.7 BHP	possibly removed in 1967	[AWOIS]
Captain R.J. Sanders	AWOIS: 8372	fishing vessel		Lafitte, LA		41.1 ft long, 14.1 ft wide, 4.1 ft deep	0/0/1967	capsized	**28-53.5-00N, 89-23.6-00W** (pos. approx.); E of project area	sunk	sunk in 9 fathoms [NM] (1967); in 1971 area cleared to 68 ft, but wreck not located
Espisisa	AWOIS: 8367	fishing vessel					0/0/1973		**28-55-00N, 89-25-00W** (pos. approx.); NE of proj area	missing from reported location	sunk 200 yds in outside channel at mi 19.2 BHP [6AWOIS]
Kiva		gas screw	1917		69		10/1/39	burned	off entrance of SW Pass		[B]
Nola		gas screw; steel	1919		595 net		11/9/22	burned	**28-55-00N, 89-40-00W**; SW of SW Pass		longitude erroneously listed as 89-04-00 [USCGS], [B]
Victoria		oil screw	1923		117		11/1/27	burned	at Buras, LA		[B]
Compadre		oil screw	1929		85		7/20/53	burned	halfway between head and mouth of passes		[B]
Buccaneer		oil screw	1954		64		11/8/65	foundered	approx. 20 mi W of SW Pass		[B]
Malcolm B. Toomer		oil screw	1954		78		11/11/66	foundered	SW of SW Pass		[B]
Mingo		schooner; steel	1904		397		3/19/20	collided with unknown steamer	at SW Pass		2 lives lost [B]
Yuma		steam screw					3/17/26	unknown	**28-56-35N, 89-26-37W**; N of proj. area		[HO], [B]

Vessel/ Obstruction Name	Record No.	Vessel/ Obstruction Type	Year Built	Place Built	Tons	Dimensions	Date Lost or Reported	Cause	Location	Disposition	Notes: Sources
Virginia	AWOIS: 290 Naval: 36,000	steam screw tanker; steel	1941		8,472 [HO]; 10,731 [B]		5/12/42	sunk by submarine	reported at approx. pos.: **28-53-06N, 89-26-42W,** and: **28-53-00N, 89-29-00W**	reported silted over, 12/20/43	27 lives lost; lay 150 yds from red SW Pass Wreck Lighted Buoy No. 2, and discontinued 12/20/43 cleared w/o hang to 54 ft; located in 1950: [USCGS], [HO], [B], [NM]
Halo		steam screw tanker; steel	1920		4,301 [USCGS]; 6986 [B]		5/20/42	sunk by submarine	**28-47-00N, 89-49-00W**; also reported at: **28-42-00N, 90-21-00W**, and **28-42-00N, 90-08-00W**; 21 mi SW of SW Pass		39 lives lost [USCGS], [B]
Tiger		steam side wheel	1837	Wheeling, VA	364		11/13/1844	exploded	at SW Pass		3 lives lost [B]
Grampus		steam side wheel	1827	Cincinnati, OH	297		5/13/1840	exploded	at mouth of Miss. River		2 lives lost [B], [LH]
obstruction	AWOIS: 8373	submerged piling					6/7/05		reported 1 ft above water in 1993 E of proj. area at: **28-54-30N, 89-26-24W** (pos. approx.)		[AWOIS]
obstruction	AWOIS: 295 Naval: 36,682	unknown							**28-54-24.86N, 89-27-06.17W** (pos. approx. to 1 mi); N of project area		reported . Hydrographic Office files dated 7/16/43 [AWOIS]

Vessel/ Obstruction Name	Record No.	Vessel/ Obstruction Type	Year Built	Place Built	Tons	Dimensions	Date Lost or Reported	Cause	Location	Disposition	Notes: Sources
obstruction	AWOIS: 8369	unknown							reported in 1971 E of proj. area in 26 ft at: **28-54-04N, 89-25-41W**; in 1976 at: **28-54-04N, 89-25-42W**; in 1993 at 50 m from AWOIS position; 750 yds N of #8370		[AWOIS]
obstruction	AWOIS: 8370	unknown							reported E of proj. area in 1993 at: **28-53-48N, 89-25-42W**		[AWOIS]
obstruction	Naval: 33011	unknown							**28-52-42N, 89-24-48W;** E of proj. area		[Navy]

Table 7. Possible Bottom Obstruction Types from Industrial, Commercial, Military, and other Sources

(source: Coastal Environments, Inc., 1977)

Obstr. Type	Materials	Obstr. Type	Materials	Obstr. Type	Materials
Industrial		**Commercial Mariners**		**Miscellaneous**	
bridge debris	concrete, metal	anchors	metal	artificial reefs	various
cables	metallic core	chains	metal	automobiles	metal
chains	metallic core	equipment	metal	concrete forms	concrete
drilling bits	metallic core	fishing tackle	metal, plastic	tires	rubber
drums	metal	nets	fiber, plastic	etc.	
lost/broken tools	metal	various junk	various		
oil wells	metal				
pipe stems	metal				
pipelines	metal				
spoil areas	channel dredging				

Table 8. Targets from South West Pass ODMDS Survey Area

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlation (with Sonar)
Target 1									
M6	1	12:28:55.5	12:29:07.0	00:11.5	94	MC	3888990.9	149061.9	
M121	2	13:41:03.2	13:41:14.7	00:11.5	55	MC	3888916.6	149052.1	A4
M122	2	13:41:59.6	13:42:03.5	00:03.9	151	D	3888911.1	149052.1	
M123	2	13:42:16.6	13:42:17.7	00:01.1	94	+	3888909.3	149052.1	
A4	2	13:41:07	13:41:10				3888916.6	149052.1	M121
Target 2									
M7	1	12:29:11.9	12:29:15.2	00:03.3	62	+	3888995.8	148892.5	
M8	1	12:29:24.5	12:29:33.8	00:09.3	70	MC	3888997.2	148844.8	
Target 3									
M32	1	12:42:00.4	12:42:47.3	00:46.9	68	D	3889126.4	142134.4	
M36	1	12:44:26.4	12:44:40.6	00:14.2	29	MC	3889142.6	142125.0	
Target 4									
M98	2	13:25:03.9	13:25:12.7	00:08.8	74	+	3889010.1	141829.3	
M155	3	14:11:58.2	14:12:00.9	00:02.7	68	+	3888931.6	141866.8	
M156	3	14:12:05.3	14:12:07.0	00:01.7	100	+	3888932.0	141805.8	
M157	3	14:12:10.2	14:12:11.3	00:01.1	115	+	3888932.2	141768.6	
M158	3	14:12:17.9	14:12:20.7	00:02.8	46	D	3888932.7	141698.5	
Target 5									
M136	3	13:59:38.7	13:59:43.6	00:04.9	59	D	3888810.2	148027.3	
Note: Visually identified as Buoy G "1"									
Target 6									
M179	3	14:20:04.3	14:20:08.1	00:03.8	57	+	3888996.4	137716.9	
M180	3	14:20:10.3	14:20:13.6	00:03.3	109	+	3888996.7	137675.7	
Target 7									
M196	3	14:24:22.9	14:24:26.2	00:03.3	22	-	3889016.9	135547.9	
M197	3	14:24:28.9	14:24:30.6	00:01.7	103	+	3889017.5	135507.0	
Target 8									
M257	5	15:37:29.0	15:37:39.4	00:10.4	27	-	3888560.1	150853.6	
Note: Visually identified as Buoy G "3"									
Target 9									
M301	5	16:09:48.7	16:09:54.1	00:05.4	30	D	3888830.4	135351.9	
M302	5	16:09:57.4	16:10:00.7	00:03.3	21	-	3888830.9	135292.8	
Target 10									
M346	6	16:55:28.5	16:55:32.4	00:03.9	59	D	3888532.9	146900.0	
M347	6	16:55:35.1	16:55:38.4	00:03.3	140	D	3888531.6	146949.3	
Target 11									
M518	10A	12:13:04.9	12:13:10.4	00:05.5	40	D	3888350.1	133594.1	
M519	10A	12:13:13.2	12:13:17.0	00:03.8	25	MC	3888351.5	133541.6	
Target 12									
M379	7	10:41:50.1	10:41:55.0	00:04.9	13	+	3888478.2	144265.8	
M380	7	10:42:01.1	10:42:04.9	00:03.8	15	-	3888479.6	144212.0	
Target 13									
M402	8	10:03:58.0	10:04:00.7	00:02.7	14	D	3888337.4	146028.2	
M428	9	11:05:10.1	11:05:16.7	00:06.6	15	MC	3888254.2	146135.7	
M477	10	11:39:32.5	11:39:39.6	00:07.1	10	D	3888138.1	146165.6	
M567	11	12:49:18.5	12:49:25.6	00:07.1	24	MC	3888064.0	146047.4	
M599	12	13:16:11.4	13:16:16.9	00:05.5	40	-	3887967.7	146033.8	

Note: Assocated with a possible shipwreck identified from NOAA charts.

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlation (with Sonar)
Target 14									
M413	9	10:55:04.1	10:55:08.4	00:04.3	48	D	3888333.6	142068.0	
M414	9	10:55:11.2	10:55:16.7	00:05.5	25	D	3888331.7	142121.0	
Target 15									
M420	9	11:00:21.5	11:00:30.2	00:08.7	10	MC	3888278.7	144270.1	
M421	9	11:00:34.1	11:00:37.9	00:03.8	15	+	3888279.2	144333.4	
Target 16									
M441	9	11:10:52.4	11:11:01.1	00:08.7	17	+	3888208.4	148398.8	
M442	9	11:11:04.4	11:11:08.2	00:03.8	19	-	3888207.9	148456.3	
Target 17									
M537	11	12:34:02.3	12:34:08.9	00:06.6	24	D	3888182.4	138403.1	
M544	11	12:34:02.3	12:34:10.5	00:08.2	24	MC	3888182.0	138424.1	
Target 18									
M539	11	12:34:44.5	12:34:50.6	00:06.1	40	MC	3888175.9	138733.3	
M546	11	12:34:44.5	12:34:50.6	00:06.1	40	MC	3888176.2	138716.5	
Target 19									
M540	11	12:35:10.3	12:35:15.8	00:05.5	11	D	3888172.0	138929.6	
M547	11	12:35:05.3	12:35:19.0	00:13.7	12	MC	3888172.2	138917.0	
Target 20									
M640	13	13:53:18.2	13:53:23.1	00:04.9	21	-	3888026.9	134018.8	
M641	13	13:53:24.2	13:53:28.6	00:04.4	24	D	3888026.5	134059.1	
M789	14	15:19:24.0	15:19:31.1	00:07.1	13	MC	3887952.6	134051.5	
Target 21									
M668	13	14:17:41.0	14:17:44.8	00:03.8	75	+	3887893.8	143411.0	
M669	13	14:17:47.0	14:17:50.8	00:03.8	101	D	3887891.2	143459.6	
Target 22									
M671	13	14:18:37.3	14:18:41.2	00:03.9	19	+	3887877.1	143868.0	
M672	13	14:18:45.6	14:18:48.9	00:03.3	46	D	3887876.1	143924.8	
Target 23									
M696	13	14:28:29.5	14:28:35.0	00:05.5	28	-	3887809.4	148274.0	
M697	13	14:28:37.2	14:28:44.9	00:07.7	14	MC	3887809.9	148331.9	
Target 24									
M730	14	14:53:12.4	14:53:16.8	00:04.4	17	-	3887750.5	147428.6	
M731	14	14:53:22.2	14:53:27.7	00:05.5	15	D	3887753.2	147365.8	
Target 25									
M841	17	17:48:28.2	17:48:31.5	00:03.3	21	-	3887455.7	144428.6	
M842	17	17:48:32.1	17:48:34.8	00:02.7	29	-	3887455.2	144459.4	
Target 26									
M879	19	11:17:58.3	11:18:01.1	00:02.8	26	+	3887178.4	151501.1	
M880	19	11:18:02.2	11:18:04.4	00:02.2	33	+	3887178.2	151530.5	
Target 27									
M889	20	11:38:29.6	11:38:30.7	00:01.1	34	+	3887238.2	141034.5	
M890	20	11:38:31.3	11:38:32.4	00:01.1	44	+	3887238.4	141017.3	
Target 28									
M897	20	11:48:18.2	11:48:19.8	00:01.6	22	+	3887340.8	134897.0	
M898	20	11:48:19.8	11:48:22.6	00:02.8	28	-	3887341.1	134874.3	
M899	20	11:48:23.7	11:48:25.3	00:01.6	21	+	3887341.4	134840.1	
Target 29									
M917	21	12:23:12.5	12:23:14.2	00:01.7	26	+	3887108.7	143149.8	
M918	21	12:23:16.9	12:23:19.1	00:02.2	34	-	3887108.3	143176.7	
Target 30									
M920	21	12:24:06.2	12:24:07.8	00:01.6	37	-	3887103.3	143524.9	
M921	21	12:24:12.2	12:24:14.4	00:02.2	47	+	3887102.8	143563.3	
Target 31									
M965	23	13:41:11.2	13:41:12.3	00:01.1	27	-	3887010.7	136452.1	
M966	23	13:41:12.3	13:41:14.0	00:01.7	24	-	3887010.6	136465.1	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlation (with Sonar)
Target 32									
M982	23	14:03:57.1	14:03:58.2	00:01.1	21	+	3886845.1	146840.6	
M983	23	14:04:03.2	14:04:04.9	00:01.7	27	+	3886844.0	146884.8	
Target 33									
M1004	25	14:56:49.8	14:56:51.5	00:01.7	31	+	3886859.5	134304.4	
M1008	25	15:09:00.1	15:09:01.7	00:01.6	35	+	3886858.5	134311.6	
Target 34									
M1006	25	15:03:30.0	15:03:31.7	00:01.7	75	+	3886857.7	133600.9	
M1007	25	15:03:35.5	15:03:37.1	00:01.6	62	+	3886855.7	133643.4	
Target 35									
M1027	25	15:25:56.2	15:25:58.4	00:02.2	42	-	3886713.5	142668.3	
M1028	25	15:26:03.9	15:26:05.5	00:01.6	28	-	3886711.8	142731.0	
M1029	25	15:26:05.5	15:26:06.6	00:01.1	30	-	3886711.5	142744.6	
Target 36									
M1030	25	15:26:36.2	15:26:39.0	00:02.8	23	-	3886704.5	143001.1	
M1031	25	15:26:41.2	15:26:44.0	00:02.8	21	-	3886703.5	143037.7	
Target 37									
M1035	25	15:32:20.9	15:32:22.6	00:01.7	26	-	3886663.8	145721.1	
M1051	26	15:57:01.0	15:57:02.6	00:01.6	37	+	3886555.9	145870.3	
M1052	26	15:57:04.2	15:57:05.3	00:01.1	25	+	3886557.0	145842.5	
M1053	26	15:57:12.4	15:57:12.9	00:00.5	23	+	3886560.0	145770.9	
Note: Assocated with a possible shipwreck identified from NOAA charts.									
Target 38									
M1048	26	15:50:51.3	15:50:54.1	00:02.8	28	-	3886465.3	149461.4	
M1049	26	15:50:54.1	15:51:10.0	00:15.9	68	D	3886466.0	149434.4	
Target 39									
M1069	27	16:29:16.8	16:29:19.0	00:02.2	36	+	3886695.8	132351.8	
M1070	27	16:29:21.1	16:29:22.8	00:01.7	62	+	3886695.1	132389.1	
Target 40									
M1079	27	16:34:08.3	16:34:09.4	00:01.1	31	+	3886651.3	134847.9	
M1080	27	16:34:13.8	16:34:15.5	00:01.7	22	-	3886650.4	134894.9	
Target 41									
M1081	27	16:34:39.0	16:34:40.6	00:01.6	52	+	3886646.6	135110.5	
M1082	27	16:34:40.6	16:34:42.8	00:02.2	50	+	3886646.3	135124.2	
Target 42									
M1085	27	16:35:13.5	16:35:16.8	00:03.3	54	D	3886641.1	135414.8	
M1086	27	16:35:18.9	16:35:20.1	00:01.2	23	+	3886640.5	135452.4	
Target 43									
M1098	27	16:43:19.3	16:43:22.0	00:02.7	36	-	3886572.9	139547.2	
M1099	27	16:43:25.3	16:43:26.9	00:01.6	47	+	3886571.4	139599.4	
Target 44									
M1100	27	16:43:41.7	16:43:42.8	00:01.1	44	+	3886567.3	139744.7	
M1101	27	16:43:46.6	16:43:48.3	00:01.7	36	-	3886566.1	139790.4	
M1102	27	16:43:52.2	16:43:53.8	00:01.6	47	+	3886564.9	139836.1	
Target 45									
M1118	27	16:55:30.6	16:55:32.7	00:02.1	22	+	3886460.3	146169.3	
M1119	27	16:55:36.1	16:55:38.8	00:02.7	42	-	3886459.7	146215.7	
Target 46									
M1120	27	16:55:48.6	16:55:49.7	00:01.1	22	-	3886458.2	146317.2	
M1121	27	16:55:52.0	16:55:54.2	00:02.2	29	+	3886457.7	146350.0	
Target 47									
M1123	27	16:57:12.5	16:57:14.7	00:02.2	65	+	3886448.3	147028.6	
M1124	27	16:57:14.7	16:57:16.4	00:01.7	45	+	3886448.0	147047.1	
Target 48									
M1132	27	17:04:04.5	17:04:06.7	00:02.2	37	+	3886409.9	150423.6	
M1133	27	17:04:06.7	17:04:08.3	00:01.6	52	+	3886409.7	150441.5	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlation (with Sonar)
Target 49									
M1156	29	17:41:49.9	17:41:51.0	00:01.1	66	+	3886439.0	132449.8	
M1157	29	17:41:54.8	17:41:55.9	00:01.1	25	+	3886438.8	132492.3	
M1158	29	17:41:58.1	17:41:59.7	00:01.6	22	-	3886438.7	132520.3	
Target 50									
M1160	29	17:42:28.2	17:42:29.9	00:01.7	36	+	3886437.6	132779.6	
M1161	29	17:42:30.4	17:42:31.5	00:01.1	62	+	3886437.5	132798.5	
Target 51									
M1163	29	17:42:57.8	17:42:59.4	00:01.6	20	+	3886422.3	133011.8	
M1164	29	17:43:02.2	17:43:03.3	00:01.1	48	+	3886417.8	133042.9	
Target 52									
M1167	30	09:54:02.5	09:54:12.3	00:09.8	221	D	3886093.7	150112.4	
M1220	30	18:14:46.9	18:14:53.4	00:06.5	123	-	3886096.9	150066.4	
Target 53									
M1169	30	09:55:38.8	09:55:40.5	00:01.7	25	+	3886110.7	149212.6	
M1218	30	18:12:58.9	18:13:02.8	00:03.9	39	D	3886109.5	149156.5	
Target 54									
M1172	30	10:01:41.4	10:01:42.5	00:01.1	29	+	3886167.8	145549.8	
M1173	30	10:01:43.6	10:01:45.3	00:01.7	21	+	3886168.3	145528.3	
M1210	30	18:06:22.2	18:06:23.8	00:01.6	131	+	3886165.2	145564.4	
Target 55									
M1174	30	10:02:40.0	10:02:43.8	00:03.8	27	-	3886181.4	144978.6	
M1208	30	18:05:24.0	18:05:25.7	00:01.7	64	-	3886174.4	145022.9	
Target 56									
M1179	30	10:22:28.9	10:22:31.0	00:02.1	30	+	3886296.6	136199.4	
M1193	30	17:50:39.4	17:50:40.6	00:01.2	30	+	3886315.8	136277.6	
M1226	31	10:39:02.2	10:39:04.4	00:02.2	50	-	3886223.2	136087.7	
M1227	31	10:39:10.5	10:39:12.1	00:01.6	27	-	3886222.0	136156.4	
M1228	31	10:39:17.1	10:39:19.8	00:02.7	30	+	3886221.0	136211.0	
Target 57									
M1189	30	17:48:38.2	17:48:39.3	00:01.1	72	+	3886320.8	135068.8	
M1190	30	17:48:40.4	17:48:42.6	00:02.2	81	+	3886320.7	135090.7	
Target 58									
M1213	30	18:10:32.7	18:10:34.9	00:02.2	66	+	3886127.4	147867.8	
M1214	30	18:10:35.4	18:10:37.6	00:02.2	49	-	3886127.1	147891.5	
Target 59									
M1232	31	10:41:44.8	10:41:47.0	00:02.2	21	-	3886198.9	137441.0	
M1233	31	10:41:49.2	10:41:51.4	00:02.2	22	-	3886198.2	137477.6	
Target 60									
M1256	32	11:11:21.1	11:11:29.3	00:08.2	50	D	3885846.7	151637.6	
M1323	33	12:40:31.8	12:40:40.1	00:08.3	51	-	3885790.0	151587.4	
M1353	35	14:16:50.0	14:16:54.4	00:04.4	22	-	3885560.1	150952.0	A35
M1364	36	14:41:18.5	14:41:20.1	00:01.6	45	-	3885461.8	150761.7	
M1382	37	16:14:05.6	16:14:08.9	00:03.3	34	+	3885389.8	149721.7	
M1391	38	16:22:21.7	16:22:23.9	00:02.2	22	D	3885275.4	150398.4	
M1392	38	16:22:54.1	16:22:56.8	00:02.7	23	-	3885278.9	150099.7	
M1434	40A	09:46:07.8	09:46:11.1	00:03.3	8	-	3885084.6	149782.5	
M1435	40A	09:46:13.9	09:46:20.9	00:07.0	12	MC	3885083.9	149704.5	
M1557	41	10:49:43.8	10:49:53.1	00:09.3	12	MC	3884991.2	149586.2	
M1572	42	10:59:28.6	10:59:37.4	00:08.8	41	+	3884880.4	149285.8	
M1573	42	11:00:16.3	11:00:21.3	00:05.0	13	D	3884887.3	148793.9	
M1574	42	11:00:26.7	11:00:28.9	00:02.2	11	D	3884888.6	148700.6	
M1620	43	11:59:10.3	11:59:23.9	00:13.6	19	MC	3884795.1	149009.3	
M1644	44	12:15:14.2	12:15:22.4	00:08.2	20	D	3884710.6	148368.2	
M1645	44	12:15:25.7	12:15:31.2	00:05.5	17	D	3884714.9	148255.8	
M1646	44	12:15:37.7	12:15:44.3	00:06.6	15	MC	3884720.5	148112.2	
M1817	48	14:35:11.9	14:35:14.7	00:02.8	33	D	3884336.5	146816.4	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlation (with Sonar)
M1862	49	15:23:46.8	15:23:48.4	00:01.6	28	+	3884272.4	146832.2	
M1919	51	17:22:17.5	17:22:19.7	00:02.2	30	-	3884048.0	146447.7	
M1951	52	17:41:50.4	17:41:51.5	00:01.1	32	+	3883956.8	145756.6	
M1952	52	17:41:33.5	17:41:34.5	00:01.0	51	+	3883953.7	145984.9	
M1955	52	17:40:39.1	17:40:47.9	00:08.8	54	-	3883943.9	146717.0	
M2037	54	13:17:34.3	13:17:36.6	00:02.3	88	+	3883784.2	144954.7	
M2038	54	13:18:05.1	13:18:06.2	00:01.1	137	+	3883780.3	145173.0	
M2040	54	13:18:30.3	13:18:31.4	00:01.1	85	+	3883777.2	145351.7	
M2165	57	15:37:43.1	15:37:44.2	00:01.1	52	+	3883489.9	144013.5	
M2210	58	16:21:46.2	16:21:48.9	00:02.7	53	+	3883385.7	143727.3	
M2295	60a	17:43:20.0	17:43:26.0	00:06.0	103	MC	3883207.9	143542.8	
M2296	60a	17:43:33.7	17:43:35.9	00:02.2	56	D	3883206.2	143633.8	
M2316	62	13:00:33.6	13:01:38.5	01:04.9	87	D	3882888.4	143284.9	
M2321	64	14:48:57.1	14:49:37.2	00:40.1	60	+	3882697.3	143106.5	
M2327	66	16:12:51.3	16:13:24.3	00:33.0	52	+	3882502.7	142999.0	
M2334	68	17:35:23.4	17:36:30.6	01:07.2	19.5	D	3882297.5	142963.2	
A35	35A	14:16:34	14:17:08				3885560.1	150952.0	M1353
Note: Assocated with a possible pipeline identified from NOAA charts.									
M1263	32	11:20:14.7	11:20:15.8	00:01.1	33	-	3885879.4	146661.9	
M1264	32	11:20:17.5	11:20:20.2	00:02.7	30	D	3885879.6	146626.1	
Target 62									
M1266	32	11:23:47.2	11:23:50.0	00:02.8	31	+	3885892.5	144662.0	
M1267	32	11:23:51.1	11:23:53.3	00:02.2	38	-	3885892.7	144625.8	
Target 63									
M1271	32	11:25:01.4	11:25:02.5	00:01.1	23	-	3885897.0	143964.4	
M1272	32	11:25:08.5	11:25:09.6	00:01.1	20	+	3885897.5	143897.6	
M1273	32	11:25:14.5	11:25:16.7	00:02.2	26	D	3885897.9	143830.8	
M1274	32	11:25:22.2	11:25:23.3	00:01.1	45	+	3885898.3	143768.7	
M1275	32	11:30:46.9	11:30:49.1	00:02.2	20	D	3885984.4	143881.7	
M1318	33	12:26:02.5	12:26:04.1	00:01.6	31	+	3885888.1	143833.5	
Target 64									
M1276	32	11:34:42.4	11:34:44.0	00:01.6	65	-	3886010.0	142055.9	
M1277	32	11:34:48.5	11:34:49.6	00:01.1	26	+	3886011.4	142003.5	
Target 65									
M1276	32	11:34:42.4	11:34:44.0	00:01.6	65	-	3886010.0	142055.9	
M1321	33	12:33:03.3	12:33:06.1	00:02.8	23	-	3885837.1	147604.1	
M1350	35	13:55:16.8	13:55:19.0	00:02.2	21	-	3885779.7	147612.0	
Target 66									
M1279	32	11:37:36.1	11:37:37.7	00:01.6	26	+	3886049.9	140552.7	
M1280	32	11:37:39.4	11:37:41.0	00:01.6	25	+	3886050.4	140522.4	
Target 67									
M1304	33	12:01:34.2	12:01:36.4	00:02.2	22	D	3886068.8	133265.7	
M1305	33	12:01:41.3	12:01:42.4	00:01.1	61	-	3886065.2	133323.2	
Target 68									
M1330	34	13:15:43.1	13:15:44.7	00:01.6	21	D	3885955.3	133003.8	
M1332	35	13:27:40.7	13:27:42.9	00:02.2	39	-	3885905.5	133002.0	
Target 69									
M1333	35	13:28:34.4	13:28:35.5	00:01.1	30	-	3885901.5	133475.5	
M1334	35	13:28:40.4	13:28:43.1	00:02.7	43	-	3885901.0	133528.4	
M1335	35	13:28:46.4	13:28:48.1	00:01.7	27	-	3885900.5	133581.8	
Target 70									
M1358	35	14:23:05.6	14:23:07.2	00:01.6	58	-	3885613.6	147774.3	
M1359	35	14:23:11.0	14:23:13.2	00:02.2	44	+	3885614.0	147721.8	
Target 71									
M1385	37	16:17:23.5	16:17:34.5	00:11.0	245	+	3885333.4	151304.2	
M1387	38	16:20:39.3	16:20:51.9	00:12.6	564	+	3885274.7	151283.3	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlation (with Sonar)
Target 72									
M1388	38	16:21:35.2	16:21:36.8	00:01.6	48	+	3885274.9	150801.4	A41
M1389	38	16:21:40.6	16:21:42.8	00:02.2	39	+	3885274.9	150754.4	A42
M1390	38	16:21:45.0	16:21:48.3	00:03.3	36	D	3885274.9	150716.5	
A41	38	16:21:26	16:21:30				3885274.9	150801.4	M1388
A42	38	16:21:31	16:21:36				3885274.9	150754.4	M1389
Target 73									
M1407	38	16:47:48.1	16:47:50.8	00:02.7	29	D	3885516.8	135494.2	
M1408	38	16:47:53.0	16:47:55.8	00:02.8	25	D	3885517.6	135447.0	
Target 74									
M1462	40A	09:55:10.3	09:55:14.1	00:03.8	14	MC	3885203.1	144041.4	
M1463	40A	09:55:15.7	09:55:22.4	00:06.7	33	MC	3885201.3	143994.7	
Target 75									
M1516	41	10:24:03.1	10:24:06.4	00:03.3	11	-	3885215.1	135418.2	
M1517	41	10:24:08.5	10:24:14.0	00:05.5	14	D	3885214.3	135461.9	
Target 76									
M1547	41	10:43:16.6	10:43:19.8	00:03.2	18	D	3885069.2	146127.1	A46
M1548	41	10:43:22.0	10:43:25.3	00:03.3	16	D	3885068.7	146171.7	
A46	41	10:43:08	10:43:18				3885069.2	146127.1	M1547
Target 77									
M1621	43	11:59:47.5	12:00:20.5	00:33.0	365	-	3884790.4	149356.2	
M1641	44	12:13:47.7	12:13:53.7	00:06.0	16	MC	3884689.0	149357.8	
M1735	45	13:12:02.6	13:12:10.3	00:07.7	63	-	3884610.1	149349.7	
Target 78									
M1661	44	12:22:42.8	12:23:02.0	00:19.2	14	MC	3884795.4	143206.8	
M1662	44	12:23:06.4	12:23:21.2	00:14.8	14	MC	3884796.6	143176.3	
Target 79									
M1673	44	12:27:16.4	12:27:19.6	00:03.2	14	D	3884854.2	140303.9	
M1674	44	12:27:22.4	12:27:25.7	00:03.3	44	D	3884854.5	140244.3	
Target 80									
M1685	44	12:30:44.5	12:30:47.3	00:02.8	17	D	3884872.5	138058.1	
M1686	44	12:30:50.6	12:30:53.9	00:03.3	23	-	3884874.4	137993.9	
Target 81									
M1710	45	12:49:35.3	12:49:36.9	00:01.6	36	+	3884803.6	136724.6	
M1711	45	12:49:40.8	12:49:43.5	00:02.7	45	-	3884802.5	136777.0	
Target 82									
M1714	45	12:51:08.5	12:51:10.2	00:01.7	53	-	3884785.4	137614.6	
M1715	45	12:51:12.9	12:51:14.0	00:01.1	40	-	3884784.5	137656.5	
Target 83									
M1716	45	12:51:48.5	12:51:51.8	00:03.3	37	D	3884777.2	138016.6	
M1761	46	13:38:27.5	13:38:29.7	00:02.2	37	-	3884666.6	138008.9	
M1762	46	13:39:06.6	13:39:07.7	00:01.1	41	+	3884672.0	138008.9	
Target 84									
M1717	45	12:52:09.3	12:52:11.0	00:01.7	44	+	3884773.5	138194.4	
M1718	45	12:52:11.5	12:52:13.1	00:01.6	34	+	3884773.1	138215.4	
Target 85									
M1739	45	13:14:27.7	13:14:29.9	00:02.2	33	-	3884586.4	150685.4	
M1740	45	13:14:31.6	13:14:33.8	00:02.2	43	+	3884585.8	150720.8	
Target 86									
M1764	46	13:40:51.3	13:40:52.4	00:01.1	30	-	3884694.2	136841.6	
M1765	46	13:40:53.5	13:40:55.1	00:01.6	65	+	3884694.8	136817.8	
Target 87									
M1769	46	13:42:05.2	13:42:06.3	00:01.1	35	+	3884714.6	136026.3	
M1770	46	13:42:06.3	13:42:07.4	00:01.1	45	+	3884714.9	136014.1	
Target 88									
M1779	47	13:51:48.6	13:51:50.3	00:01.7	44	+	3884659.5	133397.6	
M1780	47	13:51:53.0	13:51:54.1	00:01.1	84	+	3884658.9	133443.1	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlation (with Sonar)
Target 89									
M1796	47	14:08:31.0	14:08:32.1	00:01.1	39	-	3884490.1	143741.6	
M1797	47	14:08:36.5	14:08:37.6	00:01.1	136	+	3884489.0	143794.8	
Target 90									
M1799	47	14:09:12.1	14:09:13.2	00:01.1	38	+	3884481.7	144139.1	
M1800	47	14:09:15.9	14:09:17.6	00:01.7	31	+	3884480.9	144175.8	
Target 91									
M1837	49	15:03:26.4	15:03:27.5	00:01.1	30	+	3884444.5	135202.4	
M1838	49	15:03:29.2	15:03:31.4	00:02.2	86	D	3884443.9	135230.7	
Target 92									
M1840	49	15:04:21.3	15:04:22.9	00:01.6	43	+	3884433.1	135767.2	
M1841	49	15:04:26.7	15:04:28.9	00:02.2	28	-	3884432.0	135823.8	
Target 93									
M1875	50	15:42:53.1	15:42:55.3	00:02.2	25	-	3884080.8	149375.0	
M1910	51	17:27:29.8	17:27:33.1	00:03.3	28	-	3883995.7	149365.5	
M1911	51	17:27:26.0	17:27:27.1	00:01.1	21	-	3883995.9	149328.8	
Target 94									
M1899	51	16:23:25.4	16:23:28.2	00:02.8	22	+	3884221.9	135980.6	
M1900	51	16:23:21.1	16:23:23.8	00:02.7	23	+	3884222.8	135936.7	
Target 95									
M1973	53	18:02:23.2	18:02:24.3	00:01.1	30	+	3884062.4	132928.5	
M1985	54	12:48:56.9	12:49:01.3	00:04.4	104	D	3883979.1	132701.0	
M1986	54	12:49:06.1	12:49:09.4	00:03.3	84	D	3883975.8	132769.6	
M1987	54	12:49:13.8	12:49:15.4	00:01.6	43	+	3883973.3	132821.4	
M1988	54	12:49:19.3	12:49:20.4	00:01.1	76	+	3883971.2	132864.2	
M1989	54	12:49:28.0	12:49:31.9	00:03.9	96	D	3883967.9	132932.8	
Target 96									
M1974	53a	18:06:47.9	18:06:49.0	00:01.1	88	-	3883897.0	135837.2	
M2006	54	12:56:08.9	12:56:10.0	00:01.1	59	+	3883893.9	135881.3	
M2007	54	12:56:10.5	12:56:12.2	00:01.7	37	+	3883893.7	135893.3	
M2008	54	12:56:12.7	12:56:14.4	00:01.7	74	+	3883893.3	135909.3	
M2089	55	14:19:17.7	14:19:18.8	00:01.1	70	+	3883850.9	134255.1	
Target 97									
M1977	53a	18:05:16.5	18:05:18.7	00:02.2	45	D	3883904.3	134775.8	
M1978	53a	18:05:14.3	18:05:15.4	00:01.1	39	+	3883904.4	134730.5	
M1979	53a	18:05:11.5	18:05:13.7	00:02.2	48	-	3883905.9	134698.7	
Target 98									
M1980	54	12:47:57.7	12:47:59.9	00:02.2	54	D	3884001.9	132223.6	
M1981	54	12:48:00.5	12:48:10.9	00:10.4	87	MC	3884000.0	132262.9	
Target 99									
M1983	54	12:48:28.4	12:48:30.6	00:02.2	98	-	3883990.4	132464.9	
M1984	54	12:48:33.3	12:48:37.2	00:03.9	87	MC	3883987.9	132516.3	
Target 100									
M1992	54	12:51:15.0	12:51:16.7	00:01.7	45	-	3883939.6	133741.8	
M1993	54	12:51:18.9	12:51:20.5	00:01.6	68	-	3883939.0	133769.8	
Target 101									
M1996	54	12:52:21.2	12:52:23.4	00:02.2	117	D	3883929.3	134224.0	
M1997	54	12:52:24.5	12:52:25.6	00:01.1	59	-	3883928.8	134247.9	
M2089	55	14:19:17.7	14:19:18.8	00:01.1	70	+	3883850.9	134255.1	
Target 102									
M1998	54	12:54:00.5	12:54:01.6	00:01.1	38	-	3883913.9	134946.8	
M1999	54	12:54:04.9	12:54:06.6	00:01.7	80	+	3883913.2	134978.8	
M2000	54	12:54:06.6	12:54:07.6	00:01.0	40	+	3883912.9	134990.8	
Target 103									
M2001	54	12:54:15.9	12:54:17.0	00:01.1	47	+	3883911.6	135054.9	
M2002	54	12:54:18.6	12:54:19.8	00:01.2	99	+	3883911.1	135078.8	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlation (with Sonar)
Target 104									
M2014	54	13:00:10.6	13:00:11.7	00:01.1	184	+	3883888.7	137562.3	
M2015	54	13:00:12.8	13:00:15.6	00:02.8	55	D	3883888.1	137589.4	
Target 105									
M2051	54	13:25:56.4	13:25:58.0	00:01.6	81	+	3883716.8	148499.4	
M2052	54	13:26:00.8	13:26:02.4	00:01.6	74	+	3883716.7	148532.0	
M2053	54	13:26:05.7	13:26:07.3	00:01.6	49	+	3883716.6	148568.7	
M2054	54	13:26:11.2	13:26:12.3	00:01.1	45	-	3883716.4	148609.2	
M2055	54	13:26:18.3	13:26:19.9	00:01.6	63	+	3883716.2	148662.1	
Target 106									
M2060	54	13:29:32.4	13:29:34.5	00:02.1	68	D	3883710.6	150101.4	
M2061	54	13:29:36.2	13:29:40.6	00:04.4	61	D	3883710.4	150129.6	
M2062	54	13:29:42.2	13:29:43.9	00:01.7	38	+	3883710.3	150174.4	
Target 107									
M2109	56	14:47:37.9	14:47:40.1	00:02.2	45	+	3883627.3	141928.5	
M2110	56	14:47:41.7	14:47:42.9	00:01.2	64	+	3883627.0	141961.5	
Target 108									
M2130	56	14:57:42.1	14:57:43.3	00:01.2	61	+	3883518.1	147163.0	
M2131	56	14:57:44.4	14:57:45.4	00:01.0	76	-	3883517.6	147182.0	
M2132	56	14:57:47.6	14:57:49.3	00:01.7	49	+	3883516.9	147210.7	
Target 109									
M2138	56	14:59:39.2	14:59:40.3	00:01.1	73	-	3883504.7	148182.7	
M2139	56	14:59:50.2	14:59:52.9	00:02.7	107	D	3883503.5	148292.4	
M2140	56	15:00:02.8	15:00:04.5	00:01.7	93	+	3883502.4	148388.2	
M2141	56	15:00:12.2	15:00:13.8	00:01.6	64	-	3883501.6	148469.7	
M2142	56	15:00:21.5	15:00:23.1	00:01.6	61	-	3883500.7	148550.7	
M2143	56	15:00:28.1	15:00:29.2	00:01.1	92	+	3883500.0	148608.2	
Target 110									
M2175	57	15:51:03.6	15:51:05.3	00:01.7	44	+	3883659.1	134531.3	
M2176	57	15:51:06.9	15:51:08.6	00:01.7	34	+	3883660.0	134492.8	
M2188	58	16:02:21.8	16:02:23.4	00:01.6	67	+	3883536.5	134471.0	
M2189	58	16:02:25.6	16:02:30.1	00:04.5	64	D	3883535.9	134513.4	
Target 111									
M2183	58	15:57:30.3	15:57:31.4	00:01.1	63	+	3883566.4	132430.3	
M2184	58	15:57:31.9	15:57:33.0	00:01.1	109	+	3883566.3	132441.8	
Target 112									
M2208	58	16:20:47.0	16:20:48.1	00:01.1	93	+	3883393.7	143232.8	
M2209	58	16:20:53.6	16:20:55.3	00:01.7	67	+	3883392.8	143288.0	
Target 113									
M2216	58	16:26:54.7	16:26:55.8	00:01.1	60	+	3883348.1	146273.7	
M2217	58	16:26:57.4	16:26:59.1	00:01.7	58	+	3883347.8	146295.7	
M2218	58	16:27:01.8	16:27:02.9	00:01.1	57	+	3883347.3	146331.7	
Target 114									
M2229	58	16:32:32.6	16:32:34.2	00:01.6	90	+	3883281.7	149137.1	
M2230	58	16:32:39.6	16:32:42.9	00:03.3	108	D	3883280.1	149197.8	
M2231	58	16:32:45.1	16:32:47.3	00:02.2	113	-	3883279.0	149244.7	
Target 115									
M2233	58	16:33:50.7	16:33:51.8	00:01.1	107	+	3883264.9	149804.8	
M2234	58	16:33:52.4	16:33:54.0	00:01.6	67	-	3883264.5	149818.9	

Note: Visually identified as an abandoned oil rig platform.

Target 116

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlation (with Sonar)
M2239	59	16:40:18.4	16:40:19.5	00:01.1	72	-	3883105.0	151091.9	
M2240	59	16:40:22.8	16:40:23.9	00:01.1	91	+	3883106.3	151044.2	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlation (with Sonar)
Target 117									
M2248	59	16:47:59.0	16:48:00.1	00:01.1	179	+	3883240.6	146096.7	
M2249	59	16:48:02.3	16:48:03.4	00:01.1	99	+	3883241.5	146061.0	
Target 118									
M2278	60a	17:32:50.2	17:32:52.9	00:02.7	63	D	3883276.7	138619.9	
M2279	60a	17:32:57.3	17:32:58.9	00:01.6	57	-	3883275.8	138663.3	
Target 119									
M2289	60a	17:40:21.7	17:40:22.8	00:01.1	60	-	3883233.3	142113.6	
M2290	60a	17:40:26.1	17:40:27.2	00:01.1	60	+	3883232.7	142148.4	

Table 9. Inventory of Magnetic Anomalies From South West Pass ODMDS Survey Area

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M1	1	12:24:04.7	12:24:11.9	00:07.2	96	MC	3888947.0	151631.2	
M2	1	12:24:45.3	12:24:46.5	00:01.2	58	+	3888947.6	151286.5	
M3	1	12:26:04.7	12:26:08.0	00:03.3	38	-	3888956.2	150582.0	
M4	1	12:26:20.1	12:26:22.8	00:02.7	77	+	3888957.9	150436.6	
M5	1	12:27:49.8	12:27:52.0	00:02.2	61	+	3888973.5	149669.5	
M6	1	12:28:55.5	12:29:07.0	00:11.5	94	MC	3888990.9	149061.9	
M7	1	12:29:11.9	12:29:15.2	00:03.3	62	+	3888995.8	148892.5	
M8	1	12:29:24.5	12:29:33.8	00:09.3	70	MC	3888997.2	148844.8	
M9	1	12:30:06.7	12:30:13.3	00:06.6	67	D	3889008.1	148462.9	
M10	1	12:30:22.6	12:30:27.0	00:04.4	52	-	3889011.6	148340.3	
M11	1	12:30:41.8	12:30:44.0	00:02.2	50	+	3889015.9	148189.8	
M12	1	12:31:00.4	12:31:01.5	00:01.1	57	+	3889020.2	148030.6	
M13	1	12:32:07.5	12:32:16.3	00:08.8	63	D	3889031.5	147440.6	
M14	1	12:32:49.1	12:32:54.1	00:05.0	28	+	3889035.1	147090.2	
M15	1	12:33:18.1	12:33:20.9	00:02.8	27	-	3889037.7	146846.0	
M16	1	12:33:24.7	12:33:27.5	00:02.8	51	D	3889038.4	146783.5	
M17	1	12:33:32.4	12:33:42.3	00:09.9	36	MC	3889039.3	146692.1	
M18	1	12:33:49.5	12:33:52.2	00:02.7	26	+	3889040.6	146567.3	
M19	1	12:34:01.0	12:34:11.4	00:10.4	52	MC	3889042.0	146437.4	
M20	1	12:34:27.8	12:34:30.6	00:02.8	42	-	3889044.1	146241.0	
M21	1	12:34:41.0	12:34:45.9	00:04.9	49	D	3889045.5	146106.7	
M22	1	12:34:48.1	12:35:25.8	00:37.7	25	MC	3889047.6	145900.7	
M23	1	12:35:51.5	12:35:59.2	00:07.7	27	MC	3889052.2	145460.5	
M24	1	12:36:09.6	12:36:11.8	00:02.2	35	D	3889054.2	145342.1	
M25	1	12:37:08.1	12:37:46.0	00:37.9	65	MC	3889070.3	144626.4	
M26	1	12:38:02.4	12:38:10.1	00:07.7	26	MC	3889076.3	144358.9	
M27	1	12:38:20.0	12:38:33.7	00:13.7	86	D	3889080.3	144181.2	
M28	1	12:39:59.8	12:40:05.3	00:05.5	40	D	3889098.7	143365.4	
M29	1	12:40:25.5	12:40:28.3	00:02.8	27	+	3889103.5	143150.1	
M30	1	12:40:43.0	12:40:47.4	00:04.4	18	-	3889106.9	143000.6	
M31	1	12:41:14.3	12:41:30.2	00:15.9	50	MC	3889114.0	142682.0	
M32	1	12:42:00.4	12:42:47.3	00:46.9	68	D	3889126.4	142134.4	
M33	1	12:42:47.3	12:42:59.9	00:12.6	27	MC	3889129.7	141934.6	
M34	1	12:43:12.0	12:43:30.6	00:18.6	43	+	3889133.8	141690.9	
M35	1	12:43:52.5	12:44:01.3	00:08.8	47	MC	3889137.9	141443.1	
M36	1	12:44:26.4	12:44:40.6	00:14.2	29	MC	3889142.6	142125.0	
M37	1	12:44:45.6	12:44:51.1	00:05.5	36	-	3889144.4	141048.8	
M38	1	12:46:14.3	12:46:18.1	00:03.8	63	+	3889155.1	140402.6	
M39	1	12:46:24.7	12:46:34.0	00:09.3	114	D	3889156.9	140311.5	
M40	1	12:46:44.0	12:46:49.5	00:05.5	82	D	3889159.8	140173.0	
M41	1	12:48:42.5	12:48:46.4	00:03.9	36	-	3889174.5	139267.0	
M42	1	12:49:48.8	12:49:56.5	00:07.7	15	+	3889172.4	138718.0	
M43	1	12:50:05.3	12:50:08.0	00:02.7	18	-	3889172.1	138623.3	
M44	1	12:50:27.8	12:50:33.8	00:06.0	19	MC	3889171.4	138442.9	
M45	1	12:50:37.1	12:50:44.8	00:07.7	16	MC	3889171.0	138344.2	
M46	1	12:50:44.8	12:50:56.3	00:11.5	59	MC	3889170.8	138280.1	
M47	1	12:51:45.0	12:51:49.4	00:04.4	22	D	3889171.1	137830.8	
M48	1	12:51:52.7	12:52:03.7	00:11.0	27	MC	3889172.7	137763.7	
M49	1	12:52:51.0	12:52:57.0	00:06.0	47	MC	3889183.3	137300.7	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M50	1	12:53:09.1	12:53:16.8	00:07.7	31	D	3889187.4	137121.3	
M51	1	12:53:55.7	12:54:11.5	00:15.8	30	MC	3889197.1	136700.1	
M52	1	12:54:59.3	12:55:16.9	00:17.6	30	MC	3889207.9	136228.9	
M53	1	12:55:37.1	12:55:51.4	00:14.3	24	MC	3889215.3	135906.5	
M54	1	12:55:57.4	12:56:02.9	00:05.5	20	D	3889218.1	135785.7	
M55	1	12:56:25.9	12:56:33.0	00:07.1	71	MC	3889224.1	135533.6	
M56	1	12:56:36.9	12:56:50.1	00:13.2	16	MC	3889226.4	135440.9	
M57	1	12:57:12.6	12:57:16.4	00:03.8	17	+	3889233.9	135146.2	
M58	1	12:57:29.1	12:57:42.2	00:13.1	19	MC	3889238.0	134984.8	
M59	1	12:57:45.0	12:58:04.7	00:19.7	30	MC	3889242.3	134815.1	
M60	1	12:58:17.9	12:58:27.2	00:09.3	57	MC	3889248.2	134584.9	
M61	1	12:58:30.5	12:58:34.4	00:03.9	21	D	3889250.3	134502.0	
M62	1	12:58:39.3	12:58:42.6	00:03.3	21	-	3889251.9	134437.4	
M63	1	12:59:18.2	12:59:24.8	00:06.6	67	D	3889261.0	134078.9	
M64	1	12:59:35.3	12:59:40.8	00:05.5	24	D	3889264.2	133954.5	
M65	1	13:00:05.9	13:00:12.5	00:06.6	26	D	3889270.8	133693.0	
M66	1	13:00:35.5	13:00:49.8	00:14.3	31	MC	3889275.2	133424.7	
M67	1	13:00:54.1	13:01:04.5	00:10.4	19	D	3889277.4	133244.2	
M68	1	13:01:18.8	13:01:45.8	00:27.0	55	MC	3889281.6	132909.3	
M69	1	13:02:20.9	13:02:28.0	00:07.1	11	+	3889286.1	132557.2	
M70	1	13:02:37.8	13:02:43.3	00:05.5	18	D	3889288.0	132404.2	
M71	2	13:05:49.0	13:05:57.2	00:08.2	42	-	3889205.5	132391.9	
M72	2	13:06:51.4	13:07:10.5	00:19.1	47	MC	3889188.1	132925.3	
M73	2	13:09:20.9	13:09:34.1	00:13.2	43	D	3889150.9	134071.6	
M74	2	13:09:44.5	13:09:48.9	00:04.4	66	+	3889146.0	134222.6	
M75	2	13:10:04.8	13:10:21.2	00:16.4	60	MC	3889142.0	134468.7	
M76	2	13:10:27.8	13:10:31.1	00:03.3	36	+	3889140.4	134573.9	
M77	2	13:10:53.5	13:11:02.3	00:08.8	47	MC	3889136.8	134816.5	
M78	2	13:11:23.1	13:11:31.3	00:08.2	75	D	3889133.1	135063.7	
M79	2	13:12:06.4	13:12:28.9	00:22.5	105	MC	3889135.6	135465.4	
M80	2	13:13:01.8	13:13:12.7	00:10.9	28	D	3889120.3	135920.2	
M81	2	13:13:20.4	13:13:23.7	00:03.3	32	+	3889118.7	136025.4	
M82	2	13:13:33.6	13:13:37.4	00:03.8	18	D	3889117.0	136134.9	
M83	2	13:13:43.4	13:13:55.0	00:11.6	31	MC	3889115.2	136259.0	
M84	2	13:14:33.7	13:14:40.9	00:07.2	32	+	3889109.7	136624.3	
M85	2	13:14:46.9	13:14:52.4	00:05.5	23	MC	3889107.9	136747.9	
M86	2	13:14:57.3	13:15:03.9	00:06.6	67	MC	3889106.2	136857.6	
M87	2	13:15:45.0	13:15:54.3	00:09.3	41	MC	3889104.0	137271.3	
M88	2	13:16:26.2	13:16:41.5	00:15.3	39	D	3889097.5	137633.1	
M89	2	13:16:45.4	13:16:54.1	00:08.7	59	D	3889095.2	137765.0	
M90	2	13:16:59.6	13:17:38.0	00:38.4	40	MC	3889091.0	138003.1	
M91	2	13:18:08.1	13:18:32.3	00:24.2	19	MC	3889080.1	138614.6	
M92	2	13:19:32.5	13:19:52.7	00:20.2	21	+	3889070.0	139184.4	
M93	2	13:20:30.6	13:20:42.1	00:11.5	35	MC	3889061.7	139654.3	
M94	2	13:21:30.3	13:22:04.3	00:34.0	32	MC	3889052.6	140165.5	
M95	2	13:23:20.5	13:23:30.3	00:09.8	22	MC	3889026.7	141038.0	
M96	2	13:23:39.1	13:23:46.2	00:07.1	38	MC	3889024.3	141154.8	
M97	2	13:24:17.3	13:24:19.5	00:02.2	63	+	3889018.3	141439.8	
M98	2	13:25:03.9	13:25:12.7	00:08.8	74	+	3889010.1	141829.3	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M99	2	13:25:33.0	13:25:51.7	00:18.7	22	+	3889004.0	142119.6	
M100	2	13:25:55.0	13:26:03.2	00:08.2	86	D	3889001.8	142223.3	
M101	2	13:26:09.2	13:26:14.1	00:04.9	50	D	3888999.5	142331.5	
M102	2	13:26:32.8	13:26:37.2	00:04.4	49	D	3888996.7	142518.1	
M103	2	13:27:37.5	13:27:41.8	00:04.3	48	D	3888991.6	143003.5	
M104	2	13:28:21.2	13:28:27.2	00:06.0	59	D	3888988.1	143335.0	
M105	2	13:29:24.3	13:29:29.2	00:04.9	69	D	3888983.2	143800.4	
M106	2	13:29:46.8	13:29:50.6	00:03.8	56	+	3888981.4	143970.7	
M107	2	13:29:50.6	13:30:25.7	00:35.1	71	+	3888979.7	144136.5	
M108	2	13:30:29.5	13:30:32.8	00:03.3	42	-	3888977.9	144306.5	
M109	2	13:32:12.0	13:32:17.4	00:05.4	62	D	3888969.7	145090.9	
M110	2	13:32:41.5	13:32:47.0	00:05.5	47	D	3888967.3	145310.7	
M111	2	13:33:27.6	13:33:38.0	00:10.4	63	MC	3888963.2	145679.0	
M112	2	13:33:46.2	13:33:49.5	00:03.3	95	D	3888961.9	145796.7	
M113	2	13:35:28.5	13:35:46.6	00:18.1	83	MC	3888952.2	146632.7	
M114	2	13:35:57.0	13:36:01.9	00:04.9	30	-	3888950.0	146817.3	
M115	2	13:36:04.6	13:36:10.7	00:06.1	101	-	3888949.4	146867.9	
M116	2	13:36:42.4	13:36:44.1	00:01.7	63	+	3888945.7	147126.6	
M117	2	13:37:55.3	13:38:14.0	00:18.7	43	-	3888936.8	147717.7	
M118	2	13:38:33.1	13:38:35.9	00:02.8	27	+	3888933.4	147938.3	
M119	2	13:39:14.7	13:39:23.0	00:08.3	48	D	3888928.8	148245.2	
M120	2	13:40:05.2	13:40:15.1	00:09.9	44	MC	3888922.9	148631.5	
M121	2	13:41:03.2	13:41:14.7	00:11.5	55	MC	3888916.6	149052.1	A4
M122	2	13:41:59.6	13:42:03.5	00:03.9	151	D	3888911.1	149052.1	
M123	2	13:42:16.6	13:42:17.7	00:01.1	94	+	3888909.3	149052.1	
M124	2	13:43:28.9	13:43:51.4	00:22.5	33	MC	3888897.3	150181.1	
M125	2	13:44:28.6	13:44:35.2	00:06.6	39	MC	3888890.6	150466.7	
M126	2	13:46:45.1	13:46:59.9	00:14.8	46	D	3888868.7	151368.9	
M127	3	13:53:06.7	13:53:24.3	00:17.6	25	MC	3888771.2	151589.4	
M128	3	13:54:00.4	13:54:13.1	00:12.7	28	MC	3888775.8	151060.4	
M129	3	13:54:17.5	13:54:21.3	00:03.8	33	+	3888777.0	150929.3	
M130	3	13:55:02.4	13:55:04.1	00:01.7	25	-	3888781.0	150475.1	
M131	3	13:55:11.8	13:55:28.8	00:17.0	33	MC	3888782.6	150281.4	
M132	3	13:55:45.8	13:55:56.7	00:10.9	17	-	3888785.3	149981.0	
M133	3	13:56:20.9	13:56:31.4	00:10.5	23	-	3888788.9	149617.4	
M134	3	13:57:36.0	13:57:50.3	00:14.3	41	MC	3888797.4	148983.8	
M135	3	13:58:27.0	13:58:46.7	00:19.7	230	-	3888803.1	148552.6	A6
M136	3	13:59:38.7	13:59:43.6	00:04.9	59	D	3888810.2	148027.3	
M137	3	14:00:11.5	14:00:20.9	00:09.4	51	D	3888813.8	147757.7	
M138	3	14:00:50.5	14:00:51.6	00:01.1	29	+	3888817.7	147461.4	
M139	3	14:02:23.7	14:02:26.9	00:03.2	41	D	3888828.1	146688.0	
M140	3	14:02:39.5	14:02:42.3	00:02.8	45	D	3888829.8	146557.7	
M141	3	14:03:49.7	14:03:54.7	00:05.0	120	+	3888847.3	145960.5	
M142	3	14:04:06.6	14:04:21.5	00:14.9	57	MC	3888853.0	145774.1	
M143	3	14:05:10.8	14:05:18.4	00:07.6	119	+	3888867.6	145289.9	
M144	3	14:05:36.5	14:05:40.3	00:03.8	67	MC	3888873.6	145093.9	
M145	3	14:05:51.8	14:06:01.2	00:09.4	65	MC	3888878.3	144939.0	
M146	3	14:06:23.6	14:06:25.8	00:02.2	39	+	3888885.7	144692.6	
M147	3	14:06:59.2	14:07:01.3	00:02.1	55	-	3888888.4	144394.1	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M148	3	14:07:13.9	14:07:16.1	00:02.2	79	+	3888891.2	144270.3	
M149	3	14:07:32.5	14:07:40.2	00:07.7	136	D	3888895.8	144068.0	
M150	3	14:08:27.8	14:08:41.4	00:13.6	81	MC	3888903.7	143610.3	
M151	3	14:08:56.8	14:09:02.8	00:06.0	75	MC	3888907.5	143388.2	
M152	3	14:09:55.4	14:10:17.3	00:21.9	101	MC	3888917.3	142823.5	
M153	3	14:11:31.4	14:11:38.5	00:07.1	40	MC	3888930.2	142068.1	
M154	3	14:11:45.0	14:11:47.2	00:02.2	53	D	3888930.8	141974.5	
M155	3	14:11:58.2	14:12:00.9	00:02.7	68	+	3888931.6	141866.8	
M156	3	14:12:05.3	14:12:07.0	00:01.7	100	+	3888932.0	141805.8	
M157	3	14:12:10.2	14:12:11.3	00:01.1	115	+	3888932.2	141768.6	
M158	3	14:12:17.9	14:12:20.7	00:02.8	46	D	3888932.7	141698.5	
M159	3	14:12:40.5	14:12:44.8	00:04.3	72	D	3888934.1	141496.3	
M160	3	14:12:56.3	14:13:00.8	00:04.5	43	-	3888935.1	141355.8	
M161	3	14:13:22.1	14:13:25.9	00:03.8	80	-	3888936.6	141140.0	
M162	3	14:14:23.0	14:14:25.1	00:02.1	54	+	3888941.6	140629.1	
M163	3	14:15:16.1	14:15:23.2	00:07.1	106	MC	3888952.6	140128.9	
M164	3	14:15:31.4	14:15:33.1	00:01.7	99	+	3888954.4	140049.1	
M165	3	14:15:44.1	14:15:46.8	00:02.7	73	D	3888956.9	139932.6	
M166	3	14:16:27.4	14:16:31.7	00:04.3	42	D	3888965.4	139548.5	
M167	3	14:17:09.1	14:17:10.2	00:01.1	45	+	3888972.8	139215.6	
M168	3	14:17:17.8	14:17:21.1	00:03.3	83	-	3888974.5	139136.2	
M169	3	14:17:25.5	14:17:33.2	00:07.7	51	MC	3888976.2	139061.5	
M170	3	14:17:38.1	14:17:41.9	00:03.8	70	-	3888978.4	138954.2	
M171	3	14:17:44.7	14:17:52.3	00:07.6	73	MC	3888979.5	138884.2	
M172	3	14:18:08.3	14:18:12.1	00:03.8	55	-	3888982.5	138702.8	
M173	3	14:18:23.6	14:18:25.2	00:01.6	119	+	3888984.4	138582.5	
M174	3	14:18:53.7	14:18:58.1	00:04.4	86	D	3888988.9	138308.2	
M175	3	14:19:07.9	14:19:10.6	00:02.7	41	+	3888990.5	138201.5	
M176	3	14:19:16.1	14:19:17.2	00:01.1	38	+	3888991.5	138136.7	
M177	3	14:19:30.4	14:19:37.5	00:07.1	116	MC	3888994.0	137983.7	
M178	3	14:19:53.9	14:19:57.7	00:03.8	76	MC	3888995.5	137818.2	
M179	3	14:20:04.3	14:20:08.1	00:03.8	57	+	3888996.4	137716.9	
M180	3	14:20:10.3	14:20:13.6	00:03.3	109	+	3888996.7	137675.7	
M181	3	14:20:18.0	14:20:21.8	00:03.8	46	MC	3888997.4	137601.6	
M182	3	14:20:39.3	14:20:43.1	00:03.8	102	MC	3888999.0	137417.5	
M183	3	14:20:57.9	14:21:13.3	00:15.4	90	MC	3889000.8	137219.1	
M184	3	14:21:23.2	14:21:28.6	00:05.4	39	+	3889002.2	137057.8	
M185	3	14:21:36.3	14:21:37.9	00:01.6	65	+	3889003.2	136956.5	
M186	3	14:21:47.8	14:22:04.8	00:17.0	146	MC	3889004.8	136772.4	
M187	3	14:22:14.1	14:22:26.8	00:12.7	50	MC	3889006.2	136620.6	
M188	3	14:22:41.1	14:22:48.2	00:07.1	44	-	3889008.1	136398.2	
M189	3	14:22:48.2	14:22:53.1	00:04.9	52	-	3889008.5	136356.9	
M190	3	14:23:08.4	14:23:15.5	00:07.1	37	D	3889010.4	136149.7	
M191	3	14:23:30.9	14:23:31.9	00:01.0	53	D	3889011.8	135993.0	
M192	3	14:23:40.2	14:23:42.9	00:02.7	40	D	3889012.5	135905.5	
M193	3	14:23:50.6	14:23:52.3	00:01.7	31	+	3889013.3	135822.3	
M194	3	14:24:01.6	14:24:04.9	00:03.3	86	+	3889014.5	135716.7	
M195	3	14:24:09.8	14:24:18.0	00:08.2	31	MC	3889015.7	135634.6	
M196	3	14:24:22.9	14:24:26.2	00:03.3	22	-	3889016.9	135547.9	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M197	3	14:24:28.9	14:24:30.6	00:01.7	103	+	3889017.5	135507.0	
M198	3	14:24:39.9	14:24:46.5	00:06.6	59	D	3889019.1	135397.0	
M199	3	14:25:02.4	14:25:04.6	00:02.2	32	-	3889021.6	135223.7	
M200	3	14:25:12.8	14:25:22.1	00:09.3	53	MC	3889023.8	135077.5	
M201	3	14:25:43.6	14:25:49.0	00:05.4	39	MC	3889026.9	134861.9	
M202	3	14:25:57.8	14:26:23.4	00:25.6	48	MC	3889029.7	134670.7	
M203	3	14:26:38.8	14:26:45.9	00:07.1	70	MC	3889033.5	134406.1	
M204	3	14:27:09.4	14:27:16.0	00:06.6	80	D	3889037.4	134141.9	
M205	3	14:27:46.1	14:28:00.4	00:14.3	96	MC	3889043.7	133807.2	
M206	3	14:28:15.2	14:28:23.4	00:08.2	41	MC	3889048.6	133592.3	
M207	3	14:28:44.7	14:28:54.6	00:09.9	76	D	3889055.2	133303.9	
M208	3	14:29:40.6	14:29:45.5	00:04.9	45	MC	3889065.9	132891.2	
M209	3	14:30:20.5	14:30:25.4	00:04.9	57	MC	3889075.2	132547.4	
M210	4	14:46:52.1	14:47:02.5	00:10.4	148	MC	3888982.0	133156.9	
M211	4	14:47:29.9	14:47:42.0	00:12.1	75	MC	3888977.4	133431.4	
M212	4	14:47:46.4	14:47:52.4	00:06.0	91	+	3888976.1	133507.0	
M213	4	14:47:59.0	14:48:12.2	00:13.2	148	MC	3888974.3	133607.9	
M214	4	14:48:52.2	14:48:57.1	00:04.9	86	D	3888968.9	133971.2	
M215	4	14:49:16.8	14:49:21.2	00:04.4	72	MC	3888965.3	134247.9	
M216	4	14:50:12.2	14:50:20.4	00:08.2	58	-	3888961.0	134588.2	
M217	4	14:50:43.4	14:50:47.9	00:04.5	114	D	3888956.5	134831.3	
M218	4	14:50:57.8	14:51:04.9	00:07.1	72	D	3888951.7	134952.6	
M219	4	14:52:35.9	14:52:44.1	00:08.2	82	MC	3888924.5	135688.9	
M220	4	14:52:52.4	14:53:02.8	00:10.4	29	MC	3888920.7	135815.1	
M221	4	14:54:11.9	14:54:19.6	00:07.7	102	D	3888902.9	136408.1	
M222	4	14:54:35.6	14:54:40.0	00:04.4	72	MC	3888900.5	136559.2	
M223	4	14:57:25.0	14:57:31.6	00:06.6	109	MC	3888886.9	137836.4	
M224	4	14:58:09.4	14:58:16.5	00:07.1	46	MC	3888882.9	138155.9	
M225	4	15:00:13.1	15:00:21.3	00:08.2	51	D	3888871.5	139060.0	
M226	4	15:00:35.0	15:00:39.9	00:04.9	39	-	3888869.7	139207.5	
M227	4	15:01:02.9	15:01:07.9	00:05.0	55	D	3888867.2	139403.0	
M228	4	15:01:21.6	15:01:35.3	00:13.7	84	D	3888864.8	139598.6	
M229	4	15:02:02.1	15:02:06.5	00:04.4	41	+	3888861.7	139846.2	
M230	4	15:02:38.8	15:02:59.1	00:20.3	53	MC	3888857.3	140197.8	
M231	4	15:03:12.8	15:03:22.6	00:09.8	180	MC	3888855.3	140357.6	
M232	4	15:04:03.2	15:04:07.6	00:04.4	68	D	3888850.7	140724.7	
M233	4	15:05:28.2	15:05:33.6	00:05.4	34	D	3888839.9	141362.6	
M234	4	15:06:06.1	15:06:14.8	00:08.7	56	MC	3888834.1	141664.5	
M235	4	15:07:02.6	15:07:24.5	00:21.9	46	MC	3888824.9	142144.6	
M236	4	15:08:48.3	15:08:57.6	00:09.3	72	MC	3888810.7	142891.9	
M237	4	15:09:00.9	15:09:06.4	00:05.5	67	MC	3888809.2	142966.2	
M238	4	15:13:27.6	15:13:36.3	00:08.7	73	MC	3888776.6	145060.3	
M239	4	15:14:05.5	15:14:08.7	00:03.2	56	-	3888763.8	145337.2	
M240	4	15:15:10.5	15:15:31.4	00:20.9	79	MC	3888739.7	145907.8	
M241	4	15:16:09.8	15:16:15.3	00:05.5	60	D	3888730.3	146327.1	
M242	4	15:16:36.1	15:17:00.7	00:24.6	28	MC	3888734.1	146664.0	
M243	4	15:17:10.6	15:17:23.7	00:13.1	77	MC	3888735.4	146846.0	
M244	4	15:17:55.0	15:17:58.3	00:03.3	41	+	3888737.5	147165.2	
M245	4	15:20:27.4	15:21:04.7	00:37.3	57	-	3888720.8	148528.2	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M246	4	15:21:30.0	15:21:34.3	00:04.3	55	D	3888710.5	148888.4	
M247	4	15:22:39.4	15:22:58.7	00:19.3	83	MC	3888691.8	149458.2	
M248	4	15:23:05.3	15:23:17.9	00:12.6	41	MC	3888685.7	149599.6	
M249	4	15:23:37.0	15:23:41.4	00:04.4	30	-	3888677.0	149801.5	
M250	4	15:23:51.3	15:24:27.5	00:36.2	54	MC	3888666.7	150051.8	
M251	4	15:26:20.3	15:26:49.4	00:29.1	22	-	3888674.2	150861.2	
M252	4	15:26:52.2	15:27:14.6	00:22.4	20	-	3888675.8	151039.3	
M253	4	15:27:33.8	15:28:16.5	00:42.7	60	D	3888675.7	151299.3	
M254	4	15:28:25.2	15:28:49.4	00:24.2	25	-	3888670.9	151585.2	
M255	5	15:36:15.6	15:36:28.2	00:12.6	56	D	3888551.2	151607.5	
M256	5	15:36:59.4	15:37:12.0	00:12.6	29	D	3888555.0	151114.0	
M257	5	15:37:29.0	15:37:39.4	00:10.4	27	-	3888560.1	150853.6	
M258	5	15:37:41.0	15:37:53.1	00:12.1	35	-	3888562.6	150731.3	
M259	5	15:38:03.5	15:38:16.6	00:13.1	46	-	3888569.5	150550.8	
M260	5	15:39:33.5	15:39:38.5	00:05.0	20	-	3888597.0	149837.8	
M261	5	15:39:52.2	15:40:03.7	00:11.5	40	MC	3888600.5	149655.7	
M262	5	15:40:32.1	15:40:36.0	00:03.9	81	D	3888605.4	149368.1	
M263	5	15:41:13.1	15:41:16.4	00:03.3	14	+	3888609.8	149036.9	
M264	5	15:41:55.4	15:42:10.7	00:15.3	452	D	3888614.0	148679.0	A8
M265	5	15:42:34.3	15:42:42.5	00:08.2	39	MC	3888613.2	148398.0	
M266	5	15:43:35.6	15:43:55.9	00:20.3	41	-	3888623.7	147875.4	
M267	5	15:44:52.9	15:45:03.9	00:11.0	40	MC	3888637.5	147328.5	
M268	5	15:45:15.9	15:45:23.0	00:07.1	29	D	3888641.1	147184.8	
M269	5	15:46:26.0	15:46:35.4	00:09.4	41	+	3888653.4	146656.7	
M270	5	15:47:00.0	15:47:09.4	00:09.4	40	D	3888656.5	146379.1	
M271	5	15:48:40.4	15:49:05.2	00:24.8	98	MC	3888661.9	145524.9	
M272	5	15:49:41.3	15:50:00.5	00:19.2	51	MC	3888669.4	145103.9	
M273	5	15:50:43.2	15:50:57.4	00:14.2	44	MC	3888676.3	144646.7	
M274	5	15:51:08.9	15:51:23.7	00:14.8	38	-	3888679.0	144458.4	
M275	5	15:51:40.7	15:51:52.2	00:11.5	35	MC	3888683.0	144180.5	
M276	5	15:51:57.1	15:52:01.6	00:04.5	32	D	3888684.2	144103.2	
M277	5	15:53:08.9	15:53:14.3	00:05.4	18	D	3888692.6	143540.1	
M278	5	15:53:22.5	15:53:24.8	00:02.3	96	+	3888694.2	143446.3	
M279	5	15:53:29.7	15:53:44.5	00:14.8	121	+	3888696.2	143330.6	
M280	5	15:53:53.8	15:53:57.6	00:03.8	42	D	3888698.7	143198.1	
M281	5	15:54:05.3	15:54:09.1	00:03.8	27	D	3888701.0	143097.1	
M282	5	15:55:15.5	15:55:18.8	00:03.3	26	-	3888713.4	142552.2	
M283	5	15:56:27.8	15:56:44.2	00:16.4	30	MC	3888726.3	141875.7	
M284	5	15:57:24.8	15:57:28.0	00:03.2	53	D	3888734.5	141506.0	
M285	5	15:58:01.9	15:58:14.6	00:12.7	27	MC	3888739.5	141165.7	
M286	5	15:58:27.2	15:58:32.1	00:04.9	24	D	3888739.0	140986.4	
M287	5	15:58:52.4	15:59:02.3	00:09.9	44	MC	3888738.5	140766.6	
M288	5	15:59:05.6	15:59:12.1	00:06.5	38	D	3888739.8	140672.2	
M289	5	15:59:10.5	15:59:29.1	00:18.6	24	MC	3888741.4	140577.7	
M290	5	15:59:34.6	15:59:39.0	00:04.4	25	D	3888743.8	140433.5	
M291	5	16:00:05.9	16:00:12.4	00:06.5	28	D	3888748.1	140168.1	
M292	5	16:00:17.3	16:00:27.2	00:09.9	35	MC	3888750.1	140051.1	
M293	5	16:00:46.9	16:00:51.8	00:04.9	18	MC	3888753.6	139839.5	
M294	5	16:01:27.9	16:01:34.0	00:06.1	49	D	3888760.4	139492.7	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M295	5	16:02:13.4	16:02:17.8	00:04.4	22	D	3888768.7	139127.1	
M296	5	16:03:46.0	16:03:49.3	00:03.3	31	D	3888784.9	138369.1	
M297	5	16:08:54.5	16:08:58.3	00:03.8	38	-	3888826.5	135802.6	
M298	5	16:09:07.6	16:09:15.8	00:08.2	36	D	3888827.4	135697.9	
M299	5	16:09:24.6	16:09:28.4	00:03.8	22	D	3888828.5	135566.0	
M300	5	16:09:31.1	16:09:40.4	00:09.3	28	MC	3888829.2	135492.9	
M301	5	16:09:48.7	16:09:54.1	00:05.4	30	D	3888830.4	135351.9	
M302	5	16:09:57.4	16:10:00.7	00:03.3	21	-	3888830.9	135292.8	
M303	5	16:10:12.7	16:10:19.9	00:07.2	22	D	3888832.1	135156.0	
M304	5	16:10:41.2	16:10:57.1	00:15.9	31	MC	3888836.4	134874.1	
M305	5	16:11:20.1	16:11:24.0	00:03.9	20	+	3888856.5	134595.3	
M306	5	16:11:57.4	16:12:01.2	00:03.8	54	-	3888813.6	134285.7	
M307	5	16:12:55.4	16:13:07.5	00:12.1	20	MC	3888823.9	133787.1	
M308	5	16:13:30.0	16:13:36.6	00:06.6	12	MC	3888829.8	133498.7	
M309	5	16:14:19.9	16:14:31.4	00:11.5	49	MC	3888850.0	133055.2	
M310	6	16:23:39.4	16:23:42.1	00:02.7	74	+	3888790.8	132418.1	
M311	6	16:24:22.0	16:24:26.9	00:04.9	70	D	3888784.4	132712.2	
M312	6	16:24:40.6	16:24:43.9	00:03.3	41	-	3888782.3	132843.8	
M313	6	16:24:54.3	16:24:58.7	00:04.4	53	D	3888780.6	132948.5	
M314	6	16:25:13.5	16:25:22.3	00:08.8	56	MC	3888778.2	133095.6	
M315	6	16:25:59.1	16:26:05.1	00:06.0	29	D	3888769.4	133414.8	
M316	6	16:26:10.0	16:26:27.6	00:17.6	44	MC	3888765.4	133537.3	
M317	6	16:26:54.4	16:26:59.3	00:04.9	87	D	3888750.5	133791.2	
M318	6	16:29:06.4	16:29:11.4	00:05.0	43	D	3888735.1	134706.6	
M319	6	16:29:16.9	16:29:20.7	00:03.8	46	D	3888734.6	134774.5	
M320	6	16:30:57.2	16:31:09.8	00:12.6	157	MC	3888727.1	135501.6	
M321	6	16:31:40.5	16:32:02.5	00:22.0	109	MC	3888726.1	135818.5	
M322	6	16:33:54.6	16:34:00.1	00:05.5	35	+	3888719.8	136734.4	
M323	6	16:34:42.8	16:34:47.7	00:04.9	53	D	3888709.4	137087.4	
M324	6	16:35:23.3	16:35:27.6	00:04.3	77	D	3888700.9	137376.2	
M325	6	16:36:15.9	16:36:19.7	00:03.8	11	-	3888692.1	137774.5	
M326	6	16:36:48.7	16:36:59.2	00:10.5	27	D	3888686.7	138042.6	
M327	6	16:37:47.4	16:37:51.8	00:04.4	142	D	3888678.1	138468.1	
M328	6	16:38:30.8	16:38:34.6	00:03.8	75	+	3888672.4	138782.5	
M329	6	16:38:48.3	16:39:02.0	00:13.7	101	MC	3888670.8	138966.8	
M330	6	16:39:15.1	16:39:20.6	00:05.5	39	D	3888669.4	139118.6	
M331	6	16:40:02.2	16:40:07.2	00:05.0	63	D	3888660.8	139491.8	
M332	6	16:40:18.2	16:40:22.6	00:04.4	40	-	3888657.6	139627.4	
M333	6	16:40:43.4	16:40:47.2	00:03.8	179	D	3888653.3	139808.7	
M334	6	16:41:32.2	16:41:35.4	00:03.2	43	+	3888644.6	140180.5	
M335	6	16:42:23.2	16:42:30.8	00:07.6	61	MC	3888641.5	140582.1	
M336	6	16:42:56.0	16:42:58.2	00:02.2	34	D	3888639.5	140831.7	
M337	6	16:43:07.0	16:43:10.8	00:03.8	58	+	3888638.8	140922.1	
M338	6	16:44:58.4	16:45:06.1	00:07.7	84	MC	3888631.9	141819.9	
M339	6	16:45:29.1	16:45:32.4	00:03.3	62	MC	3888629.9	142035.5	
M340	6	16:47:18.3	16:47:22.1	00:03.8	64	D	3888604.8	142904.1	
M341	6	16:48:08.7	16:48:24.0	00:15.3	52	MC	3888604.8	143332.1	
M342	6	16:50:26.7	16:50:35.9	00:09.2	51	+	3888556.6	144469.8	
M343	6	16:51:40.6	16:51:45.5	00:04.9	78	D	3888553.0	145057.8	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M344	6	16:52:34.2	16:52:55.1	00:20.9	55	MC	3888559.2	145562.7	
M345	6	16:53:04.9	16:53:14.8	00:09.9	81	MC	3888558.1	145737.6	
M346	6	16:55:28.5	16:55:32.4	00:03.9	59	D	3888532.9	146900.0	
M347	6	16:55:35.1	16:55:38.4	00:03.3	140	D	3888531.6	146949.3	
M348	6	16:57:20.3	16:57:34.0	00:13.7	207	+	3888516.4	147862.0	
M349	6	16:58:22.4	16:58:29.5	00:07.1	60	MC	3888526.3	148309.6	
M350	6	16:58:41.0	16:58:56.9	00:15.9	202	D	3888523.7	148491.3	
M351	6	16:59:29.8	16:59:36.4	00:06.6	24	MC	3888519.4	148796.3	
M352	6	17:00:40.4	17:00:43.7	00:03.3	31	D	3888503.2	149320.7	
M353	6	17:01:15.4	17:01:53.3	00:37.9	75	MC	3888487.8	149667.9	
M354	6	17:02:35.5	17:02:42.6	00:07.1	31	D	3888478.8	150103.5	
M355	6	17:03:05.0	17:03:15.4	00:10.4	41	+	3888474.9	150291.6	
M356	6	17:05:27.4	17:05:41.7	00:14.3	43	D	3888473.8	151207.4	
M357	6	17:05:45.0	17:05:52.2	00:07.2	25	+	3888475.2	151266.4	
M358	6	17:05:58.2	17:06:09.7	00:11.5	56	+	3888477.3	151354.9	
M359	7	10:30:09.1	10:30:26.6	00:17.5	214	D	3888372.4	151366.3	
M360	7	10:30:43.0	10:30:47.4	00:04.4	29	+	3888369.8	151055.4	
M361	7	10:30:58.9	10:31:07.6	00:08.7	34	+	3888369.6	150825.9	
M362	7	10:31:35.1	10:31:39.0	00:03.9	15	D	3888377.9	150409.8	
M363	7	10:31:50.5	10:31:53.2	00:02.7	17	D	3888383.8	150241.1	
M364	7	10:32:22.9	10:32:30.0	00:07.1	14	MC	3888403.6	149836.3	
M365	7	10:32:44.8	10:32:50.9	00:06.1	14	D	3888413.1	149597.5	
M366	7	10:33:34.7	10:33:40.7	00:06.0	13	MC	3888411.1	149133.8	
M367	7	10:34:28.0	10:34:33.5	00:05.5	21	MC	3888402.7	148486.9	
M368	7	10:35:34.8	10:35:40.9	00:06.1	20	MC	3888407.1	147807.6	
M369	7	10:36:21.4	10:36:24.7	00:03.3	13	-	3888416.3	147393.8	
M370	7	10:36:54.9	10:37:09.1	00:14.2	18	MC	3888424.1	147040.2	
M371	7	10:37:31.6	10:37:36.5	00:04.9	23	D	3888431.0	146732.2	
M372	7	10:38:04.0	10:38:08.4	00:04.4	13	+	3888437.4	146443.3	
M373	7	10:38:23.8	10:38:28.1	00:04.3	25	+	3888441.8	146246.8	
M374	7	10:39:27.7	10:39:33.2	00:05.5	26	D	3888456.2	145662.6	
M375	7	10:40:16.4	10:40:19.2	00:02.8	11	-	3888463.7	145190.1	
M376	7	10:40:24.1	10:40:33.9	00:09.8	19	MC	3888465.6	145066.6	
M377	7	10:40:38.3	10:40:41.1	00:02.8	19	D	3888467.0	144975.3	
M378	7	10:41:09.6	10:41:13.5	00:03.9	21	D	3888471.9	144668.3	
M379	7	10:41:50.1	10:41:55.0	00:04.9	13	+	3888478.2	144265.8	
M380	7	10:42:01.1	10:42:04.9	00:03.8	15	-	3888479.6	144212.0	
M381	7	10:42:52.1	10:42:57.6	00:05.5	14	MC	3888487.7	143663.3	
M382	7	10:43:07.5	10:43:11.8	00:04.3	20	D	3888490.0	143512.3	
M383	7	10:43:44.7	10:43:48.0	00:03.3	14	+	3888498.2	143146.6	
M384	7	10:44:09.4	10:44:13.9	00:04.5	20	D	3888503.9	142891.8	
M385	7	10:44:20.4	10:44:24.8	00:04.4	27	D	3888506.1	142795.0	
M386	7	10:44:29.2	10:44:34.1	00:04.9	13	-	3888508.1	142703.5	
M387	7	10:45:26.7	10:45:37.1	00:10.4	14	MC	3888521.8	142095.0	
M388	8	09:54:02.7	09:54:19.1	00:16.4	272	D	3888262.7	151546.1	
M389	8	09:54:39.9	09:54:43.2	00:03.3	35	D	3888261.6	151227.4	
M390	8	09:56:37.7	09:56:43.2	00:05.5	13	D	3888274.0	150049.8	
M391	8	09:57:12.2	09:57:19.9	00:07.7	14	-	3888285.3	149721.4	
M392	8	09:57:27.1	09:57:30.9	00:03.8	11	+	3888289.9	149589.1	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M393	8	09:58:35.4	09:58:38.1	00:02.7	11	D	3888309.5	148975.6	
M394	8	09:58:45.8	09:58:59.0	00:13.2	13	MC	3888314.1	148827.5	
M395	8	09:59:11.1	09:59:17.1	00:06.0	12	MC	3888319.8	148646.0	
M396	8	10:00:01.4	10:00:12.9	00:11.5	19	MC	3888331.8	148173.4	
M397	8	10:00:18.9	10:00:23.3	00:04.4	15	MC	3888333.3	148055.0	
M398	8	10:01:15.3	10:01:21.3	00:06.0	13	-	3888338.7	147538.3	
M399	8	10:02:05.7	10:02:19.9	00:14.2	33	D	3888335.6	147012.7	
M400	8	10:03:03.7	10:03:11.9	00:08.2	20	D	3888334.4	146516.8	
M401	8	10:03:30.6	10:03:34.9	00:04.3	8	D	3888334.9	146277.1	
M402	8	10:03:58.0	10:04:00.7	00:02.7	14	D	3888337.4	146028.2	
M403	8	10:04:46.2	10:04:58.8	00:12.6	17	+	3888362.2	145505.0	
M404	8	10:05:17.9	10:05:50.3	00:32.4	19	MC	3888372.2	145270.5	
M405	8	10:05:46.4	10:05:59.0	00:12.6	21	MC	3888368.1	144909.7	
M406	8	10:06:45.0	10:06:51.6	00:06.6	13	MC	3888382.4	144436.8	
M407	8	10:07:20.1	10:07:23.9	00:03.8	18	D	3888392.5	144120.1	
M408	8	10:07:41.5	10:07:46.4	00:04.9	30	D	3888395.9	143912.0	
M409	8	10:09:19.5	10:09:36.0	00:16.5	25	MC	3888403.3	142968.6	
M410	8	10:10:01.7	10:10:05.0	00:03.3	13	D	3888407.9	142606.9	
M411	8	10:10:07.7	10:10:15.4	00:07.7	14	MC	3888408.7	142539.6	
M412	8	10:10:59.3	10:11:02.6	00:03.3	24	D	3888420.2	142082.1	
M413	9	10:55:04.1	10:55:08.4	00:04.3	48	D	3888333.6	142068.0	
M414	9	10:55:11.2	10:55:16.7	00:05.5	25	D	3888331.7	142121.0	
M415	9	10:55:44.1	10:55:53.4	00:09.3	29	MC	3888323.7	142344.2	
M416	9	10:56:03.8	10:56:10.4	00:06.6	20	-	3888318.7	142484.3	
M417	9	10:56:49.9	10:56:57.6	00:07.7	19	MC	3888307.7	142794.4	
M418	9	10:57:55.7	10:58:15.5	00:19.8	23	MC	3888289.4	143305.9	
M419	9	10:59:11.4	10:59:19.1	00:07.7	14	MC	3888277.5	143792.0	
M420	9	11:00:21.5	11:00:30.2	00:08.7	10	MC	3888278.7	144270.1	
M421	9	11:00:34.1	11:00:37.9	00:03.8	15	+	3888279.2	144333.4	
M422	9	11:01:25.5	11:01:28.8	00:03.3	21	D	3888274.1	144665.4	
M423	9	11:01:49.1	11:01:53.4	00:04.3	30	D	3888270.9	144836.3	
M424	9	11:02:27.4	11:02:36.2	00:08.8	16	-	3888265.8	145103.5	
M425	9	11:02:46.0	11:02:52.1	00:06.1	13	D	3888263.3	145210.4	
M426	9	11:03:56.8	11:04:01.2	00:04.4	14	+	3888253.2	145648.4	
M427	9	11:04:13.2	11:04:21.4	00:08.2	21	D	3888250.3	145772.3	
M428	9	11:05:10.1	11:05:16.7	00:06.6	15	MC	3888254.2	146135.7	
M429	9	11:05:37.5	11:06:00.1	00:22.6	37	-	3888257.9	146358.3	
M430	9	11:06:48.3	11:06:53.8	00:05.5	26	MC	3888257.3	146773.0	
M431	9	11:06:59.8	11:07:04.2	00:04.4	20	D	3888256.7	146841.4	
M432	9	11:07:12.9	11:07:24.4	00:11.5	18	MC	3888255.7	146949.3	
M433	9	11:07:33.7	11:07:38.6	00:04.9	28	D	3888252.5	147058.0	
M434	9	11:08:00.5	11:08:04.8	00:04.3	22	D	3888246.0	147238.6	
M435	9	11:08:30.6	11:08:34.9	00:04.3	11	D	3888238.7	147441.9	
M436	9	11:08:54.0	11:08:59.5	00:05.5	14	+	3888232.8	147604.9	
M437	9	11:09:08.3	11:09:16.5	00:08.2	17	D	3888229.4	147699.4	
M438	9	11:09:20.4	11:09:52.1	00:31.7	19	MC	3888222.8	147884.5	
M439	9	11:10:21.7	11:10:30.5	00:08.8	35	D	3888211.8	148189.7	
M440	9	11:10:43.6	11:10:47.4	00:03.8	23	D	3888208.9	148326.9	
M441	9	11:10:52.4	11:11:01.1	00:08.7	17	+	3888208.4	148398.8	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M442	9	11:11:04.4	11:11:08.2	00:03.8	19	-	3888207.9	148456.3	
M443	9	11:11:20.3	11:11:33.5	00:13.2	14	MC	3888206.8	148600.6	
M444	9	11:11:49.3	11:11:55.4	00:06.1	65	D	3888205.6	148755.3	
M445	9	11:12:02.5	11:12:06.4	00:03.9	23	D	3888205.0	148842.1	
M446	9	11:12:11.9	11:12:17.4	00:05.5	44	MC	3888204.4	148914.4	
M447	9	11:12:34.4	11:12:39.9	00:05.5	23	D	3888203.3	149054.7	
M448	9	11:13:26.5	11:13:30.3	00:03.8	15	D	3888200.8	149386.6	
M449	9	11:14:05.4	11:14:10.9	00:05.5	43	D	3888198.7	149657.1	
M450	9	11:14:20.2	11:14:26.3	00:06.1	36	MC	3888198.1	149743.5	
M451	9	11:14:33.9	11:14:40.5	00:06.6	22	MC	3888197.2	149855.5	
M452	9	11:14:55.8	11:15:07.9	00:12.1	25	MC	3888196.3	149985.2	
M453	9	11:15:21.1	11:15:25.5	00:04.4	18	-	3888195.1	150140.5	
M454	9	11:15:40.2	11:15:46.8	00:06.6	33	D	3888194.2	150265.1	
M455	9	11:15:55.6	11:15:57.8	00:02.2	19	D	3888193.7	150342.6	
M456	9	11:16:25.6	11:16:37.6	00:12.0	19	MC	3888190.7	150547.9	
M457	9	11:17:02.8	11:17:08.8	00:06.0	21	MC	3888183.1	150764.6	
M458	9	11:17:18.2	11:17:22.0	00:03.8	34	-	3888179.8	150859.3	
M459	9	11:17:30.2	11:17:36.2	00:06.0	18	MC	3888177.3	150930.4	
M460	9	11:17:47.7	11:17:53.7	00:06.0	23	D	3888173.3	151045.7	
M461	9	11:17:58.7	11:18:06.9	00:08.2	20	MC	3888169.4	151113.6	A10
M462	9	11:18:49.0	11:19:14.2	00:25.2	815	D	3888146.6	151497.8	
M463	10	11:28:23.0	11:28:44.9	00:21.9	51	MC	3888071.8	151353.6	
M464	10	11:28:47.1	11:29:05.2	00:18.1	39	MC	3888071.8	151353.6	
M465	10	11:29:12.3	11:29:18.8	00:06.5	23	D	3888069.7	151167.8	
M466	10	11:29:28.2	11:29:34.2	00:06.0	27	D	3888067.9	151018.3	
M467	10	11:31:42.9	11:32:07.6	00:24.7	22	MC	3888095.7	149674.6	
M468	10	11:32:29.5	11:33:11.1	00:41.6	41.6	MC	3888111.6	149282.1	
M469	10	11:33:44.1	11:33:50.1	00:06.0	40	D	3888122.5	148790.7	
M470	10	11:34:24.0	11:34:37.7	00:13.7	15	MC	3888126.4	148428.1	
M471	10	11:35:17.7	11:35:21.5	00:03.8	19	D	3888134.4	148076.9	
M472	10	11:35:31.9	11:35:37.4	00:05.5	11	D	3888137.3	147947.5	
M473	10	11:35:55.4	11:36:08.5	00:13.1	12	-	3888140.5	147768.9	
M474	10	11:36:27.1	11:36:31.0	00:03.9	43	-	3888134.0	147555.0	
M475	10	11:37:28.6	11:37:34.6	00:06.0	15	-	3888125.3	147119.7	
M476	10	11:37:57.1	11:38:00.9	00:03.8	37	+	3888122.6	146891.2	
M477	10	11:39:32.5	11:39:39.6	00:07.1	10	D	3888138.1	146165.6	
M478	10	11:40:29.6	11:40:41.6	00:12.0	23	MC	3888162.4	145669.6	
M479	10	11:42:51.8	11:43:08.2	00:16.4	40	+	3888201.8	144543.3	
M480	10	11:44:24.9	11:44:30.4	00:05.5	20	D	3888211.0	143866.1	
M481	10	11:45:30.7	11:45:58.2	00:27.5	19	MC	3888206.5	143255.6	
M482	10	11:46:04.2	11:46:23.4	00:19.2	32	-	3888205.3	143094.8	
M483	10	11:46:34.3	11:46:42.0	00:07.7	56	D	3888203.7	142871.3	
M484	10	11:47:17.1	11:47:21.4	00:04.3	12	+	3888202.1	142547.7	
M485	10	11:47:57.1	11:48:11.3	00:14.2	26	MC	3888202.7	142196.6	
M486	10	11:48:37.6	11:48:51.3	00:13.7	14	MC	3888210.7	141868.8	
M487	10	11:49:06.7	11:49:20.4	00:13.7	14	MC	3888215.2	141683.6	
M488	10	11:49:57.2	11:50:10.4	00:13.2	16	MC	3888223.9	141301.0	
M489	10	11:50:53.1	11:50:59.7	00:06.6	104	D	3888230.3	140869.9	
M490	10	11:51:32.6	11:51:35.9	00:03.3	28	D	3888235.1	140550.2	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M491	10	11:52:32.5	11:52:36.3	00:03.8	45	-	3888230.7	140041.7	
M492	10	11:53:29.5	11:53:36.1	00:06.6	32	MC	3888239.5	139558.4	
M493	10	11:53:46.4	11:53:51.4	00:05.0	32	+	3888242.6	139437.0	
M494	10	11:54:19.9	11:54:27.1	00:07.2	19	MC	3888250.5	139161.9	
M495	10	11:54:38.5	11:54:45.7	00:07.2	18	+	3888257.9	138991.1	
M496	10	11:54:54.4	11:54:58.3	00:03.9	33	+	3888262.9	138878.8	
M497	10	11:55:52.0	11:55:56.4	00:04.4	40	-	3888284.3	138403.6	
M498	10	11:56:04.6	11:56:08.4	00:03.8	17	D	3888288.8	138305.6	
M499	10	11:56:26.4	11:56:31.9	00:05.5	35	D	3888294.5	138118.5	
M500	10	11:56:36.9	11:56:44.6	00:07.7	11	MC	3888294.9	137918.4	
M501	10	11:56:59.9	11:57:14.6	00:14.7	27	MC	3888295.1	137804.6	
M502	10	11:57:32.7	11:57:40.9	00:08.2	26	MC	3888295.7	137542.7	
M503	10	11:57:44.2	11:57:49.7	00:05.5	12	D	3888296.4	137446.8	
M504	10	11:58:16.5	11:58:19.8	00:03.3	18	D	3888298.8	137154.2	
M505	10	11:58:26.4	11:58:30.2	00:03.8	12	D	3888299.4	137072.7	
M506	10	11:58:48.8	11:58:54.8	00:06.0	16	MC	3888300.7	136865.9	
M507	10	11:59:00.8	11:59:05.8	00:05.0	14	MC	3888301.3	136774.6	
M508	10	11:59:08.0	11:59:29.3	00:21.3	13	MC	3888302.2	136625.4	
M509	10	11:59:44.6	11:59:47.9	00:03.3	12	-	3888302.4	136383.9	
M510	10	12:00:20.2	12:00:23.6	00:03.4	46	D	3888309.8	136086.9	
M511	10	12:00:54.3	12:01:01.9	00:07.6	20	MC	3888321.0	135756.9	
M512	10	12:01:16.2	12:01:22.2	00:06.0	27	D	3888326.9	135580.2	
M513	10	12:01:33.2	12:01:41.4	00:08.2	17	MC	3888332.3	135412.8	
M514	10	12:01:44.2	12:01:47.5	00:03.3	45	MC	3888334.1	135340.4	
M515	10	12:01:53.5	12:01:57.9	00:04.4	24	MC	3888336.4	135244.4	
M516	10	12:02:23.1	12:02:30.2	00:07.1	13	-	3888342.4	134630.8	
M517	10	12:03:02.5	12:03:13.5	00:11.0	35	MC	3888345.6	134630.8	
M518	10A	12:13:04.9	12:13:10.4	00:05.5	40	D	3888350.1	133594.1	
M519	10A	12:13:13.2	12:13:17.0	00:03.8	25	MC	3888351.5	133541.6	
M520	10A	12:14:32.6	12:14:43.0	00:10.4	73	MC	3888372.4	132890.7	
M521	10A	12:15:38.4	12:15:42.8	00:04.4	28	D	3888376.3	132334.1	
M522	11	12:20:49.5	12:20:57.7	00:08.2	30	D	3888267.3	132921.4	
M523	11	12:21:04.3	12:21:09.2	00:04.9	12	+	3888265.5	132994.5	
M524	11	12:21:24.5	12:21:39.3	00:14.8	14	MC	3888260.6	133175.1	
M525	11	12:22:31.9	12:22:46.2	00:14.3	44	MC	3888245.1	133637.4	
M526	11	12:23:01.6	12:23:10.9	00:09.3	20	D	3888244.9	133821.0	
M527	11	12:25:34.4	12:26:09.9	00:35.5	44	MC	3888236.7	134899.3	
M528	11	12:28:10.6	12:28:20.4	00:09.8	21	MC	3888232.1	135888.2	
M529	11	12:28:42.9	12:28:46.7	00:03.8	17	D	3888227.0	136106.5	
M530	11	12:28:57.7	12:29:03.1	00:05.4	40	D	3888224.6	136209.8	
M531	11	12:29:06.4	12:29:21.3	00:14.9	24	MC	3888222.1	136320.8	
M532	11	12:30:14.4	12:30:19.4	00:05.0	79	+	3888212.2	136749.5	
M533	11	12:30:40.8	12:30:47.9	00:07.1	10	D	3888207.8	136940.9	
M534	11	12:31:38.9	12:31:47.1	00:08.2	11	-	3888199.2	137328.5	
M535	11	12:33:18.5	12:33:28.3	00:09.8	10	D	3888188.8	138077.1	
M536	11	12:33:37.6	12:33:42.6	00:05.0	12	-	3888185.8	138231.5	
M537	11	12:34:02.3	12:34:08.9	00:06.6	24	D	3888182.4	138403.1	
M538	11	12:34:23.7	12:34:29.2	00:05.5	28	MC	3888179.0	138574.3	
M539	11	12:34:44.5	12:34:50.6	00:06.1	40	MC	3888175.9	138733.3	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M540	11	12:35:10.3	12:35:15.8	00:05.5	11	D	3888172.0	138929.6	
M541	11	12:32:36.9	12:32:54.4	00:17.5	21	MC	3888194.9	137772.2	
M542	11	12:33:03.7	12:33:17.4	00:13.7	21	MC	3888190.2	138010.1	
M543	11	12:33:37.6	12:33:43.7	00:06.1	12	D	3888185.8	138231.5	
M544	11	12:34:02.3	12:34:10.5	00:08.2	24	MC	3888182.0	138424.1	
M545	11	12:34:22.6	12:34:29.2	00:06.6	28	MC	3888179.0	138574.3	
M546	11	12:34:44.5	12:34:50.6	00:06.1	40	MC	3888176.2	138716.5	
M547	11	12:35:05.3	12:35:19.0	00:13.7	12	MC	3888172.2	138917.0	
M548	11	12:35:26.1	12:35:33.2	00:07.1	14	-	3888169.4	139062.6	
M549	11	12:35:52.4	12:36:07.8	00:15.4	16	D	3888164.9	139289.1	
M550	11	12:36:15.4	12:36:30.2	00:14.8	14	D	3888161.7	139447.7	
M551	11	12:37:32.7	12:37:45.3	00:12.6	36	MC	3888150.2	140052.4	
M552	11	12:38:52.7	12:39:00.9	00:08.2	23	+	3888138.0	140703.7	
M553	11	12:39:33.2	12:39:39.8	00:06.6	27	D	3888131.6	141028.7	
M554	11	12:39:59.5	12:40:02.2	00:02.7	19	-	3888127.4	141233.3	
M555	11	12:40:25.7	12:40:40.6	00:14.9	34	MC	3888120.4	141570.1	
M556	11	12:41:23.9	12:41:34.9	00:11.0	18	-	3888114.6	142008.8	
M557	11	12:42:52.8	12:42:58.7	00:05.9	37	D	3888110.6	142709.3	
M558	11	12:43:03.7	12:43:09.2	00:05.5	67	+	3888110.0	142812.5	
M559	11	12:43:20.1	12:43:26.7	00:06.6	60	D	3888109.6	142948.5	
M560	11	12:43:51.9	12:44:01.2	00:09.3	17	-	3888109.2	143268.2	
M561	11	12:44:35.7	12:44:44.4	00:08.7	39	MC	3888108.0	143630.7	
M562	11	12:45:04.1	12:45:12.3	00:08.2	50	MC	3888103.5	143864.0	
M563	11	12:45:35.8	12:45:55.6	00:19.8	164	D	3888097.2	144192.7	
M564	11	12:46:30.7	12:46:35.1	00:04.4	15	D	3888089.7	144584.6	
M565	11	12:47:22.3	12:47:37.6	00:15.3	48	MC	3888081.3	145090.7	
M566	11	12:47:44.2	12:48:23.1	00:38.9	32	MC	3888078.1	145399.1	
M567	11	12:49:18.5	12:49:25.6	00:07.1	24	MC	3888064.0	146047.4	
M568	11	12:50:30.7	12:50:37.9	00:07.2	27	D	3888039.2	146643.1	
M569	11	12:52:03.5	12:52:15.0	00:11.5	22	MC	3888026.5	147438.2	
M570	11	12:52:40.8	12:52:55.1	00:14.3	63	MC	3888027.3	147755.3	
M571	11	12:53:17.6	12:53:25.3	00:07.7	20	D	3888027.9	148012.3	
M572	11	12:54:11.9	12:54:16.8	00:04.9	36	D	3888022.3	148411.5	
M573	11	12:54:32.2	12:54:39.3	00:07.1	46	D	3888018.8	148569.9	
M574	11	12:56:19.7	12:56:42.8	00:23.1	76	MC	3888000.6	149410.5	
M575	11	12:56:57.6	12:57:12.4	00:14.8	37	-	3887998.5	149671.1	
M576	11	12:57:43.0	12:58:01.1	00:18.1	35	D	3887991.3	149952.7	
M577	11	12:58:23.5	12:58:45.9	00:22.4	109	D	3887983.6	150248.9	
M578	11	13:00:11.9	13:00:20.1	00:08.2	57	MC	3887966.3	150909.4	
M579	11	13:00:36.0	13:00:39.3	00:03.3	16	D	3887964.8	151045.3	
M580	11	13:00:41.0	13:00:55.8	00:14.8	75	MC	3887964.8	151117.2	
M581	11	13:01:00.6	13:01:05.1	00:04.5	28	-	3887964.8	151207.1	
M582	11	13:01:10.5	13:01:17.1	00:06.6	102	MC	3887964.8	151271.8	
M583	11	13:01:31.2	13:01:38.4	00:07.2	29	-	3887964.9	151418.8	
M584	11	13:01:50.5	13:01:53.7	00:03.2	24	D	3887964.9	151530.8	
M585	12	13:05:15.0	13:05:19.4	00:04.4	20	+	3887873.3	151633.3	
M586	12	13:05:22.7	13:05:27.6	00:04.9	19	D	3887874.4	151549.2	
M587	12	13:07:06.3	13:07:13.9	00:07.6	25	+	3887889.7	150453.6	
M588	12	13:07:26.0	13:07:44.0	00:18.0	215	-	3887890.7	150245.2	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M589	12	13:08:35.0	13:08:52.0	00:17.0	150	-	3887893.7	149597.3	
M590	12	13:09:04.6	13:09:16.1	00:11.5	20	-	3887900.2	149360.8	
M591	12	13:10:24.2	13:10:31.8	00:07.6	26	D	3887917.8	148718.9	
M592	12	13:10:47.7	13:10:53.7	00:06.0	19	MC	3887922.6	148541.8	
M593	12	13:11:16.2	13:11:22.8	00:06.6	17	-	3887929.2	148300.4	
M594	12	13:11:56.7	13:11:59.9	00:03.2	17	-	3887938.1	147978.6	
M595	12	13:13:07.3	13:13:16.1	00:08.8	28	D	3887955.6	147405.4	
M596	12	13:13:45.6	13:14:00.4	00:14.8	40	D	3887958.4	147085.2	
M597	12	13:14:38.8	13:14:49.2	00:10.4	37	D	3887961.8	146702.9	
M598	12	13:15:50.7	13:15:56.1	00:05.4	22	-	3887966.4	146185.4	
M599	12	13:16:11.4	13:16:16.9	00:05.5	40	-	3887967.7	146033.8	
M600	12	13:16:44.8	13:16:56.4	00:11.6	45	MC	3887968.5	145752.8	
M601	12	13:17:36.0	13:17:47.0	00:11.0	43	MC	3887966.0	145387.1	
M602	12	13:18:00.1	13:18:05.6	00:05.5	20	D	3887965.0	145238.1	
M603	12	13:18:47.8	13:19:16.3	00:28.5	29	MC	3887964.5	144707.9	
M604	12	13:20:09.1	13:20:40.8	00:31.7	18	-	3887967.9	144188.1	
M605	12	13:21:13.8	13:21:20.9	00:07.1	12	MC	3887981.8	143813.9	
M606	12	13:21:52.2	13:22:36.0	00:43.8	25	MC	3887995.6	143464.4	
M607	12	13:23:52.1	13:24:01.4	00:09.3	18	D	3888019.0	142658.5	
M608	12	13:24:31.0	13:24:39.8	00:08.8	31	D	3888024.4	142412.9	
M609	12	13:24:59.0	13:25:07.7	00:08.7	14	MC	3888029.5	142182.3	
M610	12	13:26:00.2	13:26:43.7	00:43.5	25	MC	3888030.4	141602.1	
M611	12	13:26:50.8	13:26:58.5	00:07.7	25	D	3888028.2	141366.1	
M612	12	13:27:05.6	13:27:11.1	00:05.5	20	D	3888026.6	141241.3	
M613	12	13:27:55.0	13:28:01.0	00:06.0	27	D	3888023.9	140860.2	
M614	12	13:31:56.1	13:32:02.7	00:06.6	54	D	3888049.6	139001.3	
M615	12	13:33:54.8	13:34:01.9	00:07.1	40	D	3888060.2	138077.2	
M616	12	13:34:21.6	13:34:24.9	00:03.3	77	+	3888066.4	137885.6	
M617	12	13:35:46.4	13:35:53.6	00:07.2	15	-	3888088.6	137196.0	
M618	12	13:36:01.8	13:36:10.0	00:08.2	26	D	3888091.9	137068.8	
M619	12	13:36:57.1	13:37:11.4	00:14.3	26	MC	3888101.3	136605.9	
M620	12	13:39:00.4	13:39:07.5	00:07.1	32	MC	3888123.8	135642.5	
M621	12	13:39:12.9	13:39:17.9	00:05.0	25	D	3888126.1	135550.3	
M622	12	13:39:28.3	13:39:37.1	00:08.8	47	D	3888129.5	135418.4	
M623	12	13:39:56.2	13:39:59.5	00:03.3	32	D	3888135.0	135203.0	
M624	12	13:40:59.9	13:41:13.7	00:13.8	48	MC	3888149.1	134630.3	
M625	12	13:41:51.4	13:41:59.2	00:07.8	33	+	3888157.7	134277.4	
M626	12	13:42:35.9	13:42:46.8	00:10.9	79	-	3888166.3	133923.9	
M627	12	13:42:55.6	13:43:05.0	00:09.4	55	D	3888170.1	133771.2	
M628	12	13:43:47.8	13:43:56.0	00:08.2	28	+	3888175.7	133337.3	
M629	12	13:44:10.2	13:44:20.1	00:09.9	21	MC	3888176.7	133169.8	
M630	12	13:44:50.2	13:45:05.6	00:15.4	36	MC	3888179.1	132771.0	
M631	12	13:45:15.4	13:45:22.5	00:07.1	23	+	3888180.1	132612.1	
M632	13	13:49:27.7	13:49:33.7	00:06.0	10	MC	3888074.9	132438.8	
M633	13	13:50:10.9	13:50:20.2	00:09.3	16	MC	3888051.5	132750.4	
M634	13	13:50:26.8	13:50:36.0	00:09.2	19	MC	3888049.1	132845.8	
M635	13	13:50:59.0	13:51:05.6	00:06.6	20	-	3888044.0	133066.3	
M636	13	13:51:11.1	13:51:27.5	00:16.4	21	MC	3888049.8	133187.7	
M637	13	13:51:32.4	13:51:41.8	00:09.4	30	D	3888068.4	133285.5	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M638	13	13:51:54.3	13:52:02.6	00:08.3	31	MC	3888066.2	133417.8	
M639	13	13:52:47.5	13:52:50.3	00:02.8	32	+	3888029.2	133784.4	
M640	13	13:53:18.2	13:53:23.1	00:04.9	21	-	3888026.9	134018.8	
M641	13	13:53:24.2	13:53:28.6	00:04.4	24	D	3888026.5	134059.1	
M642	13	13:53:48.3	13:53:51.6	00:03.3	14	+	3888037.2	134228.7	
M643	13	13:54:10.8	13:54:15.7	00:04.9	19	D	3888035.6	134407.2	
M644	13	13:54:23.4	13:54:27.8	00:04.4	20	D	3888034.7	134505.0	
M645	13	13:54:48.0	13:54:54.6	00:06.6	18	D	3888032.8	134705.4	
M646	13	13:55:09.9	13:55:21.9	00:12.0	118	MC	3888029.6	134903.3	
M647	13	13:55:26.3	13:55:30.7	00:04.4	22	D	3888038.7	134994.8	
M648	13	13:55:36.2	13:55:42.7	00:06.5	26	D	3888028.7	135077.0	
M649	13	13:57:02.1	13:57:06.5	00:04.4	115	D	3888015.9	135726.3	
M650	13	13:57:39.9	13:57:47.0	00:07.1	45	D	3888032.4	136023.1	
M651	13	13:57:52.5	13:57:58.5	00:06.0	77	MC	3888034.6	136134.4	
M652	13	13:58:36.9	13:58:46.3	00:09.4	32	MC	3888005.8	136464.5	
M653	13	13:59:27.3	13:59:33.4	00:06.1	42	+	3888002.6	136856.3	
M654	13	14:00:27.8	14:00:40.4	00:12.6	29	MC	3887976.0	137373.4	
M655	13	14:00:52.5	14:01:04.0	00:11.5	23	MC	3888000.2	137525.9	
M656	13	14:01:14.9	14:01:19.4	00:04.5	17	D	3888005.3	137677.0	
M657	13	14:01:50.0	14:01:57.1	00:07.1	43	D	3888000.3	137961.3	
M658	13	14:02:18.0	14:02:23.0	00:05.0	23	MC	3887980.8	138170.8	
M659	13	14:02:29.0	14:02:34.4	00:05.4	30	D	3887979.2	138265.5	
M660	13	14:02:39.9	14:02:45.9	00:06.0	25	MC	3887973.6	138352.9	
M661	13	14:02:53.1	14:02:58.0	00:04.9	23	MC	3887992.3	138439.4	
M662	13	14:03:07.3	14:03:11.1	00:03.8	15	-	3887985.2	138549.5	
M663	13	14:03:28.6	14:03:33.5	00:04.9	41	D	3887991.8	138713.1	
M664	13	14:15:00.0	14:15:03.3	00:03.3	29	D	3887907.0	142128.1	
M665	13	14:15:48.3	14:15:54.3	00:06.0	42	D	3887914.9	142516.7	
M666	13	14:16:41.9	14:16:46.3	00:04.4	46	-	3887913.8	142943.5	
M667	13	14:17:18.0	14:17:22.9	00:04.9	43	+	3887903.2	143238.2	
M668	13	14:17:41.0	14:17:44.8	00:03.8	75	+	3887893.8	143411.0	
M669	13	14:17:47.0	14:17:50.8	00:03.8	101	D	3887891.2	143459.6	
M670	13	14:17:58.5	14:18:02.3	00:03.8	86	+	3887886.0	143557.2	
M671	13	14:18:37.3	14:18:41.2	00:03.9	19	+	3887877.1	143868.0	
M672	13	14:18:45.6	14:18:48.9	00:03.3	46	D	3887876.1	143924.8	
M673	13	14:19:04.8	14:19:13.6	00:08.8	112	D	3887872.7	144112.4	
M674	13	14:19:22.9	14:19:27.8	00:04.9	15	-	3887870.5	144230.0	
M675	13	14:19:49.2	14:20:00.8	00:11.6	58	MC	3887867.8	144469.5	
M676	13	14:20:14.4	14:20:18.3	00:03.9	47	D	3887867.0	144629.8	
M677	13	14:20:29.8	14:20:44.6	00:14.8	68	MC	3887869.3	144802.4	
M678	13	14:20:52.9	14:20:55.6	00:02.7	81	D	3887873.1	144931.4	
M679	13	14:21:03.3	14:21:09.3	00:06.0	35	D	3887876.0	145029.9	
M680	13	14:22:12.8	14:22:19.4	00:06.6	42	D	3887863.9	145564.5	
M681	13	14:22:57.8	14:23:09.3	00:11.5	16	MC	3887854.7	145915.1	
M682	13	14:23:25.2	14:23:36.1	00:10.9	19	-	3887856.8	146101.4	
M683	13	14:23:53.7	14:23:59.2	00:05.5	22	D	3887854.5	146299.3	
M684	13	14:24:04.1	14:24:12.9	00:08.8	28	D	3887852.0	146389.6	
M685	13	14:24:16.2	14:24:22.8	00:06.6	24	MC	3887850.3	146452.4	
M686	13	14:24:38.6	14:24:44.1	00:05.5	20	MC	3887846.0	146613.4	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M687	13	14:24:48.5	14:24:54.0	00:05.5	37	MC	3887844.0	146684.1	
M688	13	14:25:04.5	14:25:26.5	00:22.0	28	MC	3887839.4	146901.4	
M689	13	14:25:53.4	14:25:58.9	00:05.5	12	-	3887842.9	147148.0	
M690	13	14:26:13.2	14:26:21.4	00:08.2	38	MC	3887839.8	147313.6	
M691	13	14:26:30.7	14:26:47.7	00:17.0	25	MC	3887828.9	147499.2	
M692	13	14:27:01.4	14:27:16.1	00:14.7	37	MC	3887818.8	147672.5	
M693	13	14:27:26.0	14:27:38.0	00:12.0	33	MC	3887814.7	147831.4	
M694	13	14:27:41.3	14:27:46.8	00:05.5	17	D	3887812.7	147934.6	
M695	13	14:27:59.4	14:28:13.0	00:13.6	23	MC	3887808.2	148130.9	
M696	13	14:28:29.5	14:28:35.0	00:05.5	28	-	3887809.4	148274.0	
M697	13	14:28:37.2	14:28:44.9	00:07.7	14	MC	3887809.9	148331.9	
M698	13	14:28:56.4	14:29:01.3	00:04.9	19	D	3887811.0	148463.4	
M699	13	14:29:08.5	14:29:18.9	00:10.4	26	D	3887812.3	148549.5	
M700	13	14:29:23.8	14:29:34.3	00:10.5	14	MC	3887815.6	148699.3	
M701	13	14:29:45.2	14:29:49.6	00:04.4	20	D	3887817.4	148782.9	
M702	13	14:30:31.8	14:30:35.7	00:03.9	20	D	3887815.2	149101.3	
M703	13	14:30:51.0	14:31:06.9	00:15.9	62	D	3887808.2	149271.8	
M704	13	14:31:34.8	14:32:01.1	00:26.3	126	+	3887794.7	149636.6	
M705	13	14:33:05.7	14:33:32.6	00:26.9	746	D	3887795.2	150226.3	
M706	13	14:33:47.4	14:33:51.8	00:04.4	23	-	3887791.1	150428.5	
M707	13	14:34:06.0	14:34:09.3	00:03.3	23	D	3887785.5	150535.6	
M708	13	14:34:16.5	14:34:24.1	00:07.6	88	MC	3887781.0	150621.5	
M709	13	14:34:26.3	14:34:31.1	00:04.8	29	MC	3887778.5	150668.1	
M710	13	14:34:40.4	14:34:45.9	00:05.5	63	MC	3887773.3	150767.7	
M711	13	14:35:01.3	14:35:05.7	00:04.4	16	-	3887767.0	150886.2	
M712	13	14:35:21.1	14:35:24.4	00:03.3	73	D	3887763.0	151023.3	
M713	13	14:35:31.0	14:35:37.0	00:06.0	49	D	3887762.3	151099.7	
M714	13	14:35:54.6	14:35:58.4	00:03.8	32	-	3887760.9	151234.8	
M715	14	14:44:56.4	14:45:19.5	00:23.1	33	D	3887665.1	151378.4	
M716	14	14:45:33.2	14:45:46.9	00:13.7	24	+	3887665.0	151100.4	
M717	14	14:46:41.7	14:46:46.6	00:04.9	22	D	3887664.6	150568.5	
M718	14	14:47:00.9	14:47:32.1	00:31.2	14	MC	3887667.2	150365.8	
M719	14	14:48:45.0	14:48:57.6	00:12.6	18	MC	3887682.0	149495.5	
M720	14	14:49:28.3	14:49:31.6	00:03.3	16	D	3887690.9	149217.0	
M721	14	14:49:47.5	14:49:54.6	00:07.1	64	MC	3887696.6	149039.6	
M722	14	14:50:08.3	14:50:14.3	00:06.0	10	D	3887701.4	148894.0	
M723	14	14:50:30.7	14:50:35.7	00:05.0	20	D	3887707.6	148704.1	
M724	14	14:50:38.9	14:50:44.5	00:05.6	20	D	3887709.7	148637.5	
M725	14	14:51:05.3	14:51:08.6	00:03.3	39	D	3887715.3	148436.6	
M726	14	14:51:34.9	14:51:39.2	00:04.3	16	D	3887721.2	148185.8	
M727	14	14:51:54.1	14:52:00.7	00:06.6	33	D	3887725.2	148016.3	
M728	14	14:52:08.3	14:52:29.7	00:21.4	28	-	3887728.8	147864.7	
M729	14	14:52:36.2	14:52:40.1	00:03.9	14	D	3887736.1	147718.0	
M730	14	14:53:12.4	14:53:16.8	00:04.4	17	-	3887750.5	147428.6	
M731	14	14:53:22.2	14:53:27.7	00:05.5	15	D	3887753.2	147365.8	
M732	14	14:53:58.4	14:54:06.7	00:08.3	24	MC	3887755.4	147069.8	
M733	14	14:54:21.5	14:54:28.1	00:06.6	15	D	3887756.6	146902.6	
M734	14	14:54:37.9	14:54:42.9	00:05.0	14	D	3887757.4	146790.6	
M735	14	14:54:53.8	14:54:56.0	00:02.2	12	D	3887758.5	146679.1	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M736	14	14:55:18.4	14:55:30.0	00:11.6	16	MC	3887761.1	146496.1	
M737	14	14:56:17.1	14:56:35.2	00:18.1	22	MC	3887767.7	146032.0	
M738	14	14:56:42.9	14:56:47.2	00:04.3	13	D	3887770.1	145869.4	
M739	14	14:57:03.2	14:57:07.5	00:04.3	28	-	3887772.3	145710.2	
M740	14	14:57:34.9	14:57:40.3	00:05.4	19	D	3887775.9	145462.2	
M741	14	14:57:45.3	14:58:06.1	00:20.8	20	MC	3887775.9	145360.9	
M742	14	14:58:20.9	14:58:41.7	00:20.8	32	MC	3887771.4	144990.8	
M743	14	14:59:03.1	14:59:30.6	00:27.5	20	MC	3887766.8	144620.2	
M744	14	15:00:20.9	15:00:24.2	00:03.3	25	D	3887767.0	144120.1	
M745	14	15:00:46.6	15:00:53.2	00:06.6	36	D	3887771.2	143893.9	
M746	14	15:01:06.3	15:01:14.6	00:08.3	34	D	3887776.6	143724.6	
M747	14	15:01:52.4	15:01:56.8	00:04.4	22	D	3887789.0	143338.0	
M748	14	15:02:04.4	15:02:08.8	00:04.4	17	D	3887793.8	143234.4	
M749	14	15:02:12.6	15:02:17.5	00:04.9	97	+	3887797.3	143163.8	
M750	14	15:02:31.2	15:02:35.6	00:04.4	22	-	3887805.3	142998.8	
M751	14	15:03:32.1	15:03:37.0	00:04.9	25	D	3887831.1	142470.6	
M752	14	15:04:12.1	15:04:19.8	00:07.7	62	MC	3887839.4	142117.6	
M753	14	15:04:26.3	15:04:32.4	00:06.1	17	MC	3887841.4	142010.8	
M754	14	15:04:35.2	15:04:40.1	00:04.9	9	-	3887843.5	141893.3	
M755	14	15:04:50.5	15:04:55.4	00:04.9	24	MC	3887845.6	141776.8	
M756	14	15:05:10.3	15:05:13.0	00:02.7	16	+	3887848.6	141611.5	
M757	14	15:05:19.6	15:05:31.1	00:11.5	33	MC	3887850.6	141504.7	
M758	14	15:05:39.3	15:05:43.2	00:03.9	17	+	3887850.5	141366.1	
M759	14	15:05:57.9	15:06:02.8	00:04.9	24	D	3887850.2	141168.2	
M760	14	15:07:10.9	15:07:14.7	00:03.8	13	D	3887849.2	140523.6	
M761	14	15:07:37.8	15:07:45.9	00:08.1	13	MC	3887848.8	140260.5	
M762	14	15:07:54.7	15:08:03.5	00:08.8	23	D	3887848.6	140107.4	
M763	14	15:08:11.1	15:08:15.0	00:03.9	16	-	3887848.3	139968.2	
M764	14	15:08:44.6	15:08:48.4	00:03.8	23	D	3887847.9	139671.2	
M765	14	15:09:29.5	15:09:41.0	00:11.5	26	MC	3887856.0	139196.7	
M766	14	15:09:52.5	15:09:56.9	00:04.4	13	-	3887858.7	139046.8	
M767	14	15:10:06.7	15:10:15.0	00:08.3	28	MC	3887861.2	138901.9	
M768	14	15:10:22.1	15:10:26.5	00:04.4	42	D	3887863.4	138776.4	
M769	14	15:11:07.6	15:11:14.7	00:07.1	22	D	3887870.9	138352.0	
M770	14	15:11:16.9	15:11:22.4	00:05.5	23	D	3887872.2	138276.8	
M771	14	15:11:47.6	15:11:53.6	00:06.0	19	MC	3887876.5	137993.8	
M772	14	15:12:17.1	15:12:28.6	00:11.5	34	MC	3887879.8	137676.7	
M773	14	15:12:49.5	15:12:55.5	00:06.0	14	D	3887882.3	137438.7	
M774	14	15:13:23.3	15:13:29.3	00:06.0	22	+	3887894.6	137132.1	
M775	14	15:13:40.8	15:13:49.6	00:08.8	24	MC	3887900.0	136965.8	
M776	14	15:14:03.3	15:14:08.2	00:04.9	46	D	3887904.3	136786.3	
M777	14	15:14:23.1	15:14:25.8	00:02.7	28	+	3887907.8	136639.6	
M778	14	15:14:37.3	15:14:43.9	00:06.6	27	D	3887911.5	136488.9	
M779	14	15:15:04.7	15:15:09.6	00:04.9	54	+	3887915.8	136268.2	
M780	14	15:15:26.1	15:15:28.8	00:02.7	14	D	3887917.2	136100.8	
M781	14	15:15:56.8	15:16:00.6	00:03.8	18	D	3887919.5	135826.5	
M782	14	15:16:51.0	15:16:59.2	00:08.2	17	MC	3887924.3	135329.7	
M783	14	15:17:20.6	15:17:26.1	00:05.5	11	D	3887934.3	135115.5	
M784	14	15:17:33.8	15:17:39.2	00:05.4	12	D	3887939.4	135006.4	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M785	14	15:17:42.5	15:17:48.0	00:05.5	12	D	3887943.3	134924.6	
M786	14	15:17:53.5	15:17:59.0	00:05.5	13	D	3887947.5	134833.7	
M787	14	15:18:17.7	15:18:24.2	00:06.5	13	D	3887952.8	134644.6	
M788	14	15:18:52.1	15:18:59.9	00:07.8	40	D	3887960.1	134331.1	
M789	14	15:19:24.0	15:19:31.1	00:07.1	13	MC	3887952.6	134051.5	
M790	14	15:19:39.3	15:19:51.4	00:12.1	17	MC	3887951.9	133884.1	
M791	14	15:20:14.4	15:20:26.0	00:11.6	18	MC	3887950.8	133620.0	
M792	14	15:20:32.5	15:20:35.8	00:03.3	67	-	3887952.8	133500.0	
M793	14	15:20:58.3	15:21:03.8	00:05.5	21	-	3887959.5	133230.7	
M794	14	15:21:25.2	15:21:27.9	00:02.7	13	+	3887965.4	133024.7	
M795	14	15:21:55.9	15:22:07.4	00:11.5	13	MC	3887979.5	132720.8	
M796	15	15:54:56.1	15:55:14.8	00:18.7	29	MC	3887867.4	132647.1	
M797	15	15:55:55.0	15:56:03.7	00:08.7	21	+	3887859.5	133053.1	
M798	15	15:56:10.9	15:56:15.5	00:04.6	86	+	3887856.7	133197.0	
M799	15	15:56:25.1	15:56:34.4	00:09.3	15	-	3887854.3	133318.9	
M800	15	15:57:01.9	15:57:06.9	00:05.0	20	D	3887848.6	133616.6	
M801	15	15:57:10.2	15:57:17.9	00:07.7	30	MC	3887846.9	133703.5	
M802	15	15:57:26.7	15:57:32.2	00:05.5	28	D	3887844.9	133812.2	
M803	15	15:57:50.4	15:57:54.2	00:03.8	14	D	3887841.6	133986.1	
M804	15	15:58:31.1	15:58:34.4	00:03.3	24	D	3887835.4	134312.1	
M805	15	15:59:03.5	15:59:07.4	00:03.9	27	D	3887830.6	134564.2	
M806	15	16:00:22.7	16:01:11.1	00:48.4	17	MC	3887817.2	135474.9	
M807	15	16:01:44.1	16:01:46.9	00:02.8	13	D	3887814.8	135803.7	
M808	15	16:02:34.1	16:02:38.0	00:03.9	11	-	3887812.4	136183.4	
M809	15	16:02:40.8	16:02:50.6	00:09.8	41	MC	3887812.3	136266.9	
M810	15	16:02:53.9	16:02:57.3	00:03.4	15	D	3887812.2	136330.4	
M811	15	16:03:27.5	16:03:32.4	00:04.9	16	D	3887813.1	136545.8	
M812	15	16:35:25.9	16:35:28.1	00:02.2	47	-	3887585.7	150396.3	
M813	15	16:35:58.9	16:36:00.0	00:01.1	68	+	3887580.0	150618.3	
M814	15	16:36:14.9	16:36:15.9	00:01.0	40	+	3887577.3	150720.5	
M815	15	16:37:50.0	16:37:51.6	00:01.6	115	+	3887569.4	151360.7	
M816	16	16:41:33.9	16:41:53.1	00:19.2	31	+	3887477.6	150795.3	
M817	16	16:42:17.3	16:42:18.9	00:01.6	15	+	3887485.2	151115.9	
M818	16	16:43:37.6	16:43:40.9	00:03.3	16	+	3887504.8	150428.3	
M819	16	16:44:24.4	16:44:27.1	00:02.7	15	-	3887513.6	150042.2	
M820	16	16:44:34.3	16:44:36.4	00:02.1	37	+	3887515.2	149961.3	
M821	16	16:49:03.2	16:49:06.5	00:03.3	35	-	3887544.5	147814.9	
M822	16	16:49:45.6	16:49:49.4	00:03.8	18	+	3887548.7	147478.6	
M823	16	16:51:25.6	16:51:27.9	00:02.3	15	+	3887558.5	146683.6	
M824	16	16:51:53.7	16:51:55.9	00:02.2	22	D	3887561.3	146452.1	
M825	16	16:54:51.4	16:55:02.9	00:11.5	93	-	3887578.6	145058.6	
M826	16	17:04:07.4	17:04:09.6	00:02.2	23	-	3887654.9	140592.4	
M827	16	17:11:23.6	17:11:24.6	00:01.0	27	+	3887680.7	136915.3	
M828	17	17:24:17.3	17:24:21.2	00:03.9	31	D	3887673.4	132719.4	
M829	17	17:26:40.9	17:26:42.6	00:01.7	66	+	3887653.1	133823.8	
M830	17	17:29:34.1	17:29:36.9	00:02.8	27	-	3887620.5	135111.4	
M831	17	17:30:18.1	17:30:19.3	00:01.2	25	-	3887615.0	135438.4	
M832	17	17:31:26.3	17:31:29.1	00:02.8	27	+	3887606.4	135964.2	
M833	17	17:33:43.9	17:33:47.1	00:03.2	90	D	3887604.5	137066.4	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M834	17	17:34:32.3	17:34:34.4	00:02.1	76	+	3887606.2	137448.6	
M835	17	17:36:22.3	17:36:25.0	00:02.7	63	+	3887583.3	138349.1	
M836	17	17:40:50.6	17:40:54.5	00:03.9	35	D	3887546.6	140606.6	
M837	17	17:41:35.8	17:41:36.8	00:01.0	95	+	3887541.6	140960.9	
M838	17	17:41:44.0	17:41:46.2	00:02.2	33	+	3887541.9	141035.3	
M839	17	17:42:25.8	17:42:27.4	00:01.6	56	+	3887523.4	141395.5	
M840	17	17:45:05.3	17:45:06.9	00:01.6	56	+	3887527.2	142685.6	
M841	17	17:48:28.2	17:48:31.5	00:03.3	21	-	3887455.7	144428.6	
M842	17	17:48:32.1	17:48:34.8	00:02.7	29	-	3887455.2	144459.4	
M843	17	17:51:12.7	17:51:14.3	00:01.6	23	+	3887451.1	145811.4	
M844	17	17:51:26.5	17:51:28.1	00:01.6	21	+	3887486.0	145918.9	
M845	17	17:59:24.9	17:59:40.9	00:16.0	210	D	3887412.7	149930.4	
M846	17	18:01:03.4	18:01:04.5	00:01.1	76	+	3887450.4	150557.6	
M847	17	18:03:10.5	18:03:11.5	00:01.0	57	-	3887395.2	151390.5	
M848	18	10:05:51.4	10:05:53.5	00:02.1	46	D	3887346.0	145617.9	
M849	18	10:07:21.8	10:07:24.0	00:02.2	25	+	3887373.9	144684.8	
M850	18	10:08:58.2	10:09:00.9	00:02.7	16	-	3887393.1	143702.0	
M851	18	10:10:16.1	10:10:18.8	00:02.7	24	+	3887406.3	142899.6	
M852	18	10:10:24.9	10:10:30.9	00:06.0	32	+	3887407.8	142809.2	
M853	18	10:16:53.4	10:16:55.6	00:02.2	40	+	3887473.6	138710.9	
M854	18	10:19:38.4	10:19:40.0	00:01.6	16	+	3887512.5	136632.2	
M855	18	10:21:14.8	10:21:19.2	00:04.4	22	D	3887528.3	135875.5	
M856	18	10:22:51.2	10:22:55.1	00:03.9	24	+	3887537.3	134856.2	
M857	18	10:24:28.2	10:24:30.4	00:02.2	17	-	3887545.3	133876.8	
M858	19	10:38:06.1	10:38:07.7	00:01.6	39	-	3887469.3	132825.6	
M859	19	10:38:18.7	10:38:20.8	00:02.1	49	-	3887467.8	132923.9	
M860	19	10:42:52.4	10:42:53.5	00:01.1	20	-	3887435.5	135000.9	
M861	19	10:43:18.7	10:43:20.8	00:02.1	23	D	3887432.3	135197.9	
M862	19	10:43:46.0	10:43:48.2	00:02.2	63	-	3887428.9	135401.7	
M863	19	10:51:12.7	10:51:13.8	00:01.1	53	+	3887376.8	138876.0	
M864	19	10:52:12.3	10:52:14.5	00:02.2	44	+	3887368.9	139352.0	
M865	19	10:52:22.7	10:52:24.9	00:02.2	24	+	3887367.6	139435.0	
M866	19	10:53:46.7	10:53:50.0	00:03.3	33	+	3887356.2	140121.3	
M867	19	10:56:35.7	10:56:38.4	00:02.7	30	+	3887333.4	141500.0	
M868	19	10:56:55.4	10:56:57.6	00:02.2	19	+	3887330.8	141661.8	
M869	19	10:59:05.9	10:59:07.5	00:01.6	22	+	3887313.1	142729.7	
M870	19	11:01:56.8	11:01:59.5	00:02.7	32	D	3887293.2	144123.1	
M871	19	11:03:27.6	11:03:29.3	00:01.7	18	+	3887280.4	144836.2	
M872	19	11:06:36.2	11:06:37.8	00:01.6	25	D	3887255.9	146336.6	
M873	19	11:06:59.8	11:07:03.1	00:03.3	21	D	3887254.0	146527.1	
M874	19	11:08:10.9	11:08:12.0	00:01.1	22	+	3887248.7	147080.1	
M875	19	11:09:48.0	11:09:50.8	00:02.8	20	+	3887244.8	147833.1	
M876	19	11:09:57.9	11:09:59.5	00:01.6	25	D	3887243.6	147917.5	
M877	19	11:14:01.6	11:14:03.2	00:01.6	31	-	3887203.9	149733.9	
M878	19	11:17:20.0	11:17:22.1	00:02.1	39	D	3887179.6	151213.4	
M879	19	11:17:58.3	11:18:01.1	00:02.8	26	+	3887178.4	151501.1	
M880	19	11:18:02.2	11:18:04.4	00:02.2	33	+	3887178.2	151530.5	
M881	20	11:25:36.0	11:25:38.8	00:02.8	22	-	3887100.3	149284.1	
M882	20	11:29:32.8	11:29:35.0	00:02.2	65	+	3887137.0	146723.9	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M883	20	11:32:16.7	11:32:26.0	00:09.3	29	-	3887162.2	144978.6	
M884	20	11:32:40.8	11:32:42.4	00:01.6	46	+	3887165.9	144722.0	
M885	20	11:32:54.4	11:32:56.6	00:02.2	37	D	3887168.2	144564.6	
M886	20	11:33:02.0	11:33:09.1	00:07.1	36	-	3887169.2	144494.7	
M887	20	11:33:23.4	11:33:25.6	00:02.2	21	-	3887172.4	144266.8	
M888	20	11:35:03.0	11:35:04.1	00:01.1	102	+	3887192.5	143212.8	
M889	20	11:38:29.6	11:38:30.7	00:01.1	34	+	3887238.2	141034.5	
M890	20	11:38:31.3	11:38:32.4	00:01.1	44	+	3887238.4	141017.3	
M891	20	11:40:16.5	11:40:18.7	00:02.2	25	-	3887253.0	139917.6	
M892	20	11:44:34.1	11:44:35.2	00:01.1	76	+	3887302.6	137232.8	
M893	20	11:45:03.6	11:45:05.8	00:02.2	33	-	3887309.0	136917.2	
M894	20	11:45:30.0	11:45:31.0	00:01.0	32	-	3887314.6	136647.0	
M895	20	11:46:28.6	11:46:30.2	00:01.6	32	-	3887327.0	136033.4	
M896	20	11:48:06.1	11:48:09.9	00:03.8	27	-	3887339.5	135022.2	
M897	20	11:48:18.2	11:48:19.8	00:01.6	22	+	3887340.8	134897.0	
M898	20	11:48:19.8	11:48:22.6	00:02.8	28	-	3887341.1	134874.3	
M899	20	11:48:23.7	11:48:25.3	00:01.6	21	+	3887341.4	134840.1	
M900	20	11:48:39.6	11:48:41.3	00:01.7	20	-	3887343.2	134675.1	
M901	20	11:48:56.0	11:48:58.2	00:02.2	27	-	3887345.0	134505.4	
M902	20	11:50:00.3	·11:50:04.1	00:03.8	26	D	3887352.1	133828.9	
M903	20	11:51:52.2	11:51:57.1	00:04.9	27	+	3887367.6	132663.8	
M904	21	11:56:54.9	11:56:57.1	00:02.2	24	D	3887261.7	132982.0	
M905	21	11:57:56.9	11:57:58.0	00:01.1	38	+	3887286.2	133381.5	
M906	21	11:58:15.5	11:58:17.1	00:01.6	50	+	3887273.6	133501.3	
M907	21	12:01:42.2	12:01:43.3	00:01.1	23	-	3887180.4	134886.9	
M908	21	12:02:14.9	12:02:16.1	00:01.2	29	-	3887246.4	135074.9	
M909	21	12:03:22.8	12:03:24.5	00:01.7	54	+	3887235.4	135538.4	
M910	21	12:06:01.2	12:06:06.1	00:04.9	20	-	3887230.4	136013.4	
M911	21	12:06:15.9	12:06:18.7	00:02.8	27	+	3887227.8	136111.8	
M912	21	12:07:05.8	12:07:07.4	00:01.6	40	+	3887218.8	136444.8	
M913	21	12:10:04.6	12:10:05.7	00:01.1	23	-	3887190.2	137647.6	
M914	21	12:17:59.0	12:18:00.7	00:01.7	20	+	3887140.2	140953.3	
M915	21	12:19:21.3	12:19:23.0	00:01.7	27	+	3887131.9	141528.8	
M916	21	12:19:34.5	12:19:36.7	00:02.2	32	-	3887130.6	141621.1	
M917	21	12:23:12.5	12:23:14.2	00:01.7	26	+	3887108.7	143149.8	
M918	21	12:23:16.9	12:23:19.1	00:02.2	34	-	3887108.3	143176.7	
M919	21	12:23:43.2	12:23:45.9	00:02.7	41	D	3887105.5	143371.8	
M920	21	12:24:06.2	12:24:07.8	00:01.6	37	-	3887103.3	143524.9	
M921	21	12:24:12.2	12:24:14.4	00:02.2	47	+	3887102.8	143563.3	
M922	21	12:24:36.3	12:24:38.5	00:02.2	49	+	3887100.8	143740.9	
M923	21	12:24:54.9	12:24:59.3	00:04.4	26	+	3887099.4	143884.5	
M924	21	12:25:05.8	12:25:08.0	00:02.2	24	-	3887098.3	143970.4	
M925	21	12:26:21.4	12:26:23.0	00:01.6	37	+	3887087.1	144576.8	
M926	21	12:26:34.0	12:26:36.2	00:02.2	29	-	3887084.8	144679.8	
M927	21	12:29:25.2	12:29:27.9	00:02.7	35	+	3887053.9	146065.9	
M928	21	12:35:06.0	12:35:07.1	00:01.1	31	+	3887011.4	148677.7	
M929	21	12:35:29.0	12:35:31.2	00:02.2	34	-	3887010.3	148849.4	
M930	21	12:37:27.8	12:37:28.9	00:01.1	38	+	3887004.4	149736.8	
M931	21	12:38:06.3	12:38:09.1	00:02.8	35	D	3887002.4	150040.7	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M932	21	12:38:46.4	12:38:47.5	00:01.1	22	+	3887000.5	150323.4	
M933	21	12:39:14.9	12:39:16.0	00:01.1	31	+	3886999.0	150536.6	
M934	21	12:39:31.4	12:39:32.5	00:01.1	57	+	3886997.6	150661.1	
M935	21	12:39:45.7	12:39:49.0	00:03.3	29	+	3886995.5	150770.1	
M936	21	12:40:38.2	12:40:39.3	00:01.1	46	+	3886988.0	151172.1	
M937	21	12:41:17.6	12:41:19.8	00:02.2	105	D	3886982.2	151478.1	
M938	21	12:41:35.2	12:41:36.8	00:01.6	62	-	3886979.7	151608.1	
M939	22	12:55:32.8	12:55:35.6	00:02.8	21	+	3886895.2	150662.7	
M940	22	12:55:53.6	12:55:57.4	00:03.8	35	-	3886897.9	150459.3	A18
M941	22	13:01:45.7	13:01:53.4	00:07.7	14	-	3886944.5	147034.9	A19
M942	22	13:06:12.0	13:06:21.8	00:09.8	34	+	3886981.1	144591.6	
M943	22	13:07:04.5	13:07:11.6	00:07.1	23	-	3886988.1	144104.4	
M944	22	13:11:27.0	13:11:28.1	00:01.1	50	+	3887022.5	141729.0	
M945	22	13:13:15.4	13:13:19.8	00:04.4	23	+	3887036.8	140729.6	
M946	22	13:13:46.6	13:13:48.3	00:01.7	30	-	3887040.9	140453.6	
M947	22	13:15:17.6	13:15:20.4	00:02.8	24	+	3887053.5	139638.5	
M948	22	13:15:28.0	13:15:30.8	00:02.8	28	-	3887054.9	139550.8	
M949	22	13:16:47.5	13:16:49.1	00:01.6	20	-	3887065.8	138843.4	
M950	22	13:17:39.6	13:17:42.4	00:02.8	43	-	3887073.0	138379.3	
M951	22	13:17:55.0	13:17:56.6	00:01.6	43	-	3887075.1	138242.6	
M952	22	13:19:07.4	13:19:09.0	00:01.6	23	-	3887085.2	137583.7	
M953	22	13:19:09.0	13:19:11.3	00:02.3	27	-	3887085.2	137583.7	
M954	22	13:19:21.6	13:19:23.3	00:01.7	48	+	3887087.0	137471.1	
M955	22	13:22:37.9	13:22:40.1	00:02.2	41	+	3887113.8	135767.9	
M956	22	13:23:14.0	13:23:15.7	00:01.7	21	+	3887118.6	135462.5	
M957	22	13:25:13.6	13:25:15.8	00:02.2	57	+	3887135.3	134446.8	
M958	22	13:27:10.4	13:27:13.6	00:03.2	23	-	3887152.5	133466.7	
M959	22	13:28:16.6	13:28:18.2	00:01.6	21	-	3887156.3	132911.7	
M960	23	13:33:55.3	13:33:56.4	00:01.1	20	+	3887049.4	133049.0	
M961	23	13:34:04.6	13:34:06.2	00:01.6	53	+	3887047.4	133121.6	
M962	23	13:34:36.9	13:34:39.6	00:02.7	38	+	3887045.6	133371.1	
M963	23	13:37:15.7	13:37:17.4	00:01.7	35	+	3887037.4	134610.0	
M964	23	13:39:15.2	13:39:17.4	00:02.2	75	+	3887024.3	135537.0	
M965	23	13:41:11.2	13:41:12.3	00:01.1	27	-	3887010.7	136452.1	
M966	23	13:41:12.3	13:41:14.0	00:01.7	24	-	3887010.6	136465.1	
M967	23	13:41:40.7	13:41:42.9	00:02.2	68	+	3887007.3	136683.9	
M968	23	13:42:10.9	13:42:13.6	00:02.7	48	+	3887003.2	136913.3	
M969	23	13:42:19.6	13:42:22.4	00:02.8	49	-	3887001.8	136985.0	
M970	23	13:43:03.5	13:43:08.5	00:05.0	47	-	3886995.3	137332.4	
M971	23	13:43:51.8	13:43:53.4	00:01.6	33	+	3886988.3	137696.3	
M972	23	13:44:08.8	13:44:11.5	00:02.7	25	-	3886985.8	137827.5	
M973	23	13:44:30.8	13:44:32.5	00:01.7	24	-	3886982.6	137997.8	
M974	23	13:53:12.9	13:53:14.0	00:01.1	31	+	3886929.2	141985.3	
M975	23	13:54:55.9	13:54:58.1	00:02.2	26	+	3886909.2	142802.1	
M976	23	13:57:02.0	13:57:05.2	00:03.2	22	+	3886898.1	143749.6	A23
M977	23	13:59:41.2	13:59:42.3	00:01.1	31	+	3886883.7	144955.1	
M978	23	14:00:08.6	14:00:09.7	00:01.1	143	-	3886880.9	145167.0	
M979	23	14:00:40.9	14:00:42.0	00:01.1	37	-	3886877.7	145407.5	
M980	23	14:02:23.3	14:02:24.4	00:01.1	23	+	3886862.9	146159.7	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M981	23	14:03:23.7	14:03:25.9	00:02.2	28	+	3886851.4	146597.9	
M982	23	14:03:57.1	14:03:58.2	00:01.1	21	+	3886845.1	146840.6	
M983	23	14:04:03.2	14:04:04.9	00:01.7	27	+	3886844.0	146884.8	
M984	23	14:05:06.7	14:05:08.9	00:02.2	59	-	3886834.8	147348.5	
M985	23	14:10:04.1	14:10:06.8	00:02.7	52	-	3886806.0	149487.8	
M986	23	14:10:32.1	14:10:33.7	00:01.6	31	-	3886801.1	149715.6	
M987	23	14:10:55.1	14:10:56.2	00:01.1	36	+	3886797.2	149902.8	
M988	23	14:12:12.2	14:12:15.0	00:02.8	29	-	3886783.9	150531.1	
M989	23	14:13:22.0	14:13:24.2	00:02.2	33	+	3886771.8	151098.9	
M990	24	14:17:07.5	14:17:08.6	00:01.1	23	+	3886661.1	151450.5	
M991	24	14:17:24.5	14:17:26.7	00:02.2	25	+	3886663.8	151286.4	
M992	24	14:20:20.3	14:20:22.5	00:02.2	54	-	3886692.2	149578.5	
M993	24	14:23:05.6	14:23:06.7	00:01.1	52	+	3886718.8	147983.0	
M994	24	14:32:56.3	14:32:57.9	00:01.6	28	+	3886818.8	142280.5	
M995	24	14:42:41.4	14:42:44.7	00:03.3	20	+	3886906.9	136803.0	
M996	24	14:47:11.6	14:47:13.2	00:01.6	20	+	3886942.4	134272.9	
M997	24	14:47:19.2	14:47:20.3	00:01.1	20	-	3886943.5	134195.9	
M998	24	14:48:25.6	14:48:26.7	00:01.1	71	+	3886952.5	133572.9	
M999	24	14:49:52.0	14:49:53.1	00:01.1	21	-	3886964.2	132761.1	
M1000	25	14:53:21.4	14:53:22.5	00:01.1	35	+	3886878.5	132574.1	
M1001	25	14:53:57.6	14:53:58.6	00:01.0	82	+	3886871.3	132866.1	
M1002	25	14:55:13.8	14:55:16.0	00:02.2	36	D	3886861.8	133503.6	
M1003	25	14:56:27.9	14:56:30.1	00:02.2	29	+	3886860.0	134119.2	
M1004	25	14:56:49.8	14:56:51.5	00:01.7	31	+	3886859.5	134304.4	
M1005	25	14:57:19.4	14:57:21.0	00:01.6	23	+	3886855.5	134555.6	
M1006	25	15:03:30.0	15:03:31.7	00:01.7	75	+	3886857.7	133600.9	
M1007	25	15:03:35.5	15:03:37.1	00:01.6	62	+	3886855.7	133643.4	
M1008	25	15:09:00.1	15:09:01.7	00:01.6	35	+	3886858.5	134311.6	
M1009	25	15:09:48.3	15:09:50.0	00:01.7	22	+	3886851.3	134708.4	
M1010	25	15:10:14.6	15:10:16.8	00:02.2	22	-	3886847.5	134924.6	
M1011	25	15:10:53.0	15:10:56.9	00:03.9	27	-	3886841.8	135240.4	
M1012	25	15:11:27.0	15:11:30.3	00:03.3	22	D	3886836.5	135533.7	
M1013	25	15:13:32.1	15:13:33.7	00:01.6	21	+	3886818.2	136548.9	
M1014	25	15:15:06.9	15:15:08.5	00:01.6	22	+	3886804.1	137283.6	
M1015	25	15:18:57.0	15:18:59.7	00:02.7	32	-	3886770.1	139221.3	
M1016	25	15:19:39.2	15:19:41.9	00:02.7	30	-	3886763.8	139568.7	
M1017	25	15:19:48.0	15:19:49.6	00:01.6	21	-	3886762.5	139640.8	
M1018	25	15:20:31.7	15:20:32.8	00:01.1	30	+	3886756.0	140000.8	
M1019	25	15:21:07.3	15:21:08.4	00:01.1	37	-	3886750.7	140293.5	
M1020	25	15:21:39.7	15:21:41.3	00:01.6	24	+	3886747.8	140557.4	
M1021	25	15:21:58.8	15:22:02.2	00:03.4	33	+	3886745.9	140719.8	
M1022	25	15:23:35.9	15:23:38.1	00:02.2	29	+	3886736.5	141510.2	
M1023	25	15:23:51.3	15:23:53.5	00:02.2	36	-	3886734.9	141641.5	
M1024	25	15:24:26.3	15:24:28.5	00:02.2	25	+	3886731.5	141929.5	
M1025	25	15:24:57.0	15:24:59.2	00:02.2	23	-	3886726.7	142181.9	
M1026	25	15:25:09.6	15:25:11.2	00:01.6	22	+	3886723.9	142285.3	
M1027	25	15:25:56.2	15:25:58.4	00:02.2	42	-	3886713.5	142668.3	
M1028	25	15:26:03.9	15:26:05.5	00:01.6	28	-	3886711.8	142731.0	
M1029	25	15:26:05.5	15:26:06.6	00:01.1	30	-	3886711.5	142744.6	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M1030	25	15:26:36.2	15:26:39.0	00:02.8	23	-	3886704.5	143001.1	
M1031	25	15:26:41.2	15:26:44.0	00:02.8	21	-	3886703.5	143037.7	
M1032	25	15:27:45.3	15:27:46.4	00:01.1	54	-	3886689.3	143564.3	
M1033	25	15:29:30.6	15:29:32.3	00:01.7	54	+	3886667.3	144409.5	
M1034	25	15:30:20.4	15:30:27.0	00:06.6	47	-	3886668.2	144789.7	
M1035	25	15:32:20.9	15:32:22.6	00:01.7	26	-	3886663.8	145721.1	
M1036	25	15:33:20.7	15:33:27.2	00:06.5	21	+	3886649.6	146174.9	
M1037	25	15:34:50.1	15:34:51.2	00:01.1	22	+	3886639.3	146843.6	
M1038	25	15:37:44.8	15:37:46.5	00:01.7	23	-	3886624.4	148131.1	
M1039	25	15:38:08.9	15:38:15.5	00:06.6	29	MC	3886633.8	148321.5	
M1040	25	15:38:36.9	15:38:38.6	00:01.7	50	+	3886631.6	148539.3	
M1041	25	15:40:29.4	15:40:30.4	00:01.0	87	+	3886622.6	149431.6	
M1042	25	15:41:29.0	15:41:35.1	00:06.1	59	MC	3886617.9	149900.8	
M1043	25	15:43:19.3	15:43:20.9	00:01.6	40	-	3886610.7	150792.1	
M1044	25	15:45:01.3	15:45:02.4	00:01.1	55	-	3886656.7	151631.8	
M1045	26	15:47:02.4	15:47:04.6	00:02.2	45	+	3886470.6	151678.5	
M1046	26	15:47:27.7	15:47:30.9	00:03.2	21	+	3886467.8	151434.7	
M1047	26	15:48:44.3	15:48:47.1	00:02.8	35	+	3886459.3	150695.5	A25
M1048	26	15:50:51.3	15:50:54.1	00:02.8	28	-	3886465.3	149461.4	
M1049	26	15:50:54.1	15:51:10.0	00:15.9	68	D	3886466.0	149434.4	
M1050	26	15:54:14.5	15:54:17.3	00:02.8	46	-	3886514.5	147467.2	
M1051	26	15:57:01.0	15:57:02.6	00:01.6	37	+	3886555.9	145870.3	
M1052	26	15:57:04.2	15:57:05.3	00:01.1	25	+	3886557.0	145842.5	
M1053	26	15:57:12.4	15:57:12.9	00:00.5	23	+	3886560.0	145770.9	
M1054	26	15:58:31.9	15:58:34.1	00:02.2	21	D	3886582.7	145091.4	
M1055	26	15:58:46.7	15:59:07.4	00:20.7	356	D	3886586.0	144967.0	
M1056	26	16:02:29.8	16:02:32.0	00:02.2	21	+	3886635.7	143085.0	
M1057	26	16:03:49.9	16:03:55.9	00:06.0	21	-	3886653.5	142410.2	
M1058	26	16:07:29.4	16:07:31.1	00:01.7	38	+	3886619.6	142323.3	
M1059	26	16:08:02.9	16:08:04.6	00:01.7	29	+	3886624.5	141999.8	
M1060	26	16:09:50.9	16:09:52.0	00:01.1	27	+	3886640.5	140957.0	
M1061	26	16:10:57.8	16:10:60.0	00:02.2	30	+	3886650.4	140310.9	
M1062	26	16:11:52.6	16:11:54.2	00:01.6	20	+	3886659.4	139779.3	
M1063	26	16:13:12.1	16:13:13.2	00:01.1	22	-	3886680.5	138987.4	
M1064	26	16:14:19.6	16:14:21.2	00:01.6	30	D	3886698.3	138315.4	
M1065	26	16:14:41.0	16:14:42.1	00:01.1	33	-	3886704.0	138102.0	
M1066	26	16:20:34.9	16:20:36.5	00:01.6	32	+	3886744.9	134656.2	
M1067	26	16:22:36.6	16:22:38.2	00:01.6	33	+	3886749.0	133489.5	
M1068	26	16:23:19.3	16:23:21.5	00:02.2	23	+	3886750.5	133080.1	
M1069	27	16:29:16.8	16:29:19.0	00:02.2	36	+	3886695.8	132351.8	
M1070	27	16:29:21.1	16:29:22.8	00:01.7	62	+	3886695.1	132389.1	
M1071	27	16:30:23.7	16:30:25.3	00:01.6	26	-	3886685.6	132924.4	
M1072	27	16:30:51.6	16:30:53.3	00:01.7	38	-	3886681.3	133163.6	
M1073	27	16:31:46.5	16:31:47.6	00:01.1	69	+	3886672.9	133633.5	
M1074	27	16:31:54.7	16:31:56.3	00:01.6	27	+	3886671.6	133703.6	
M1075	27	16:32:16.0	16:32:17.7	00:01.7	27	+	3886668.4	133886.4	
M1076	27	16:32:29.8	16:32:32.0	00:02.2	30	+	3886666.3	134004.0	
M1077	27	16:33:07.1	16:33:10.3	00:03.2	31	MC	3886660.6	134323.2	
M1078	27	16:33:45.4	16:33:47.6	00:02.2	33	+	3886654.8	134651.5	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M1079	27	16:34:08.3	16:34:09.4	00:01.1	31	+	3886651.3	134847.9	
M1080	27	16:34:13.8	16:34:15.5	00:01.7	22	-	3886650.4	134894.9	
M1081	27	16:34:39.0	16:34:40.6	00:01.6	52	+	3886646.6	135110.5	
M1082	27	16:34:40.6	16:34:42.8	00:02.2	50	+	3886646.3	135124.2	
M1083	27	16:34:47.8	16:34:50.0	00:02.2	27	+	3886645.2	135185.4	
M1084	27	16:35:04.7	16:35:06.9	00:02.2	25	+	3886642.6	135330.5	
M1085	27	16:35:13.5	16:35:16.8	00:03.3	54	D	3886641.1	135414.8	
M1086	27	16:35:18.9	16:35:20.1	00:01.2	23	+	3886640.5	135452.4	
M1087	27	16:35:27.1	16:35:28.3	00:01.2	57	+	3886639.2	135522.5	
M1088	27	16:36:37.8	16:36:38.9	00:01.1	27	-	3886628.4	136127.6	
M1089	27	16:36:53.2	16:36:54.8	00:01.6	35	+	3886626.0	136263.6	
M1090	27	16:37:14.0	16:37:15.7	00:01.7	56	+	3886622.9	136437.4	
M1091	27	16:37:32.1	16:37:33.8	00:01.7	55	-	3886620.2	136587.7	
M1092	27	16:37:45.8	16:37:48.6	00:02.8	83	-	3886618.1	136704.9	
M1093	27	16:38:43.3	16:38:44.4	00:01.1	55	+	3886610.0	137200.6	
M1094	27	16:39:14.1	16:39:16.3	00:02.2	35	-	3886607.2	137459.8	
M1095	27	16:41:33.3	16:41:34.4	00:01.1	66	+	3886595.0	138628.9	
M1096	27	16:42:13.5	16:42:16.2	00:02.7	69	+	3886589.6	138974.9	
M1097	27	16:42:57.3	16:42:58.4	00:01.1	40	+	3886578.4	139356.3	
M1098	27	16:43:19.3	16:43:22.0	00:02.7	36	-	3886572.9	139547.2	
M1099	27	16:43:25.3	16:43:26.9	00:01.6	47	+	3886571.4	139599.4	
M1100	27	16:43:41.7	16:43:42.8	00:01.1	44	+	3886567.3	139744.7	
M1101	27	16:43:46.6	16:43:48.3	00:01.7	36	-	3886566.1	139790.4	
M1102	27	16:43:52.2	16:43:53.8	00:01.6	47	+	3886564.9	139836.1	
M1103	27	16:44:29.9	16:44:33.2	00:03.3	34	D	3886556.0	140190.0	
M1104	27	16:44:59.5	16:45:01.7	00:02.2	34	+	3886549.0	140462.8	
M1105	27	16:46:18.0	16:46:20.2	00:02.2	93	+	3886530.6	141187.9	
M1106	27	16:46:59.1	16:47:01.8	00:02.7	45	+	3886521.0	141567.1	
M1107	27	16:48:16.9	16:48:18.5	00:01.6	82	+	3886504.0	142286.9	
M1108	27	16:48:32.7	16:48:34.4	00:01.7	43	-	3886502.3	142436.4	
M1109	27	16:49:01.2	16:49:02.9	00:01.7	31	-	3886499.3	142704.8	
M1110	27	16:49:48.8	16:49:50.5	00:01.7	24	-	3886494.2	143153.8	
M1111	27	16:50:34.9	16:50:37.1	00:02.2	29	-	3886489.3	143588.3	
M1112	27	16:50:43.2	16:50:46.5	00:03.3	94	D	3886488.4	143666.1	
M1113	27	16:51:10.7	16:51:12.3	00:01.6	39	+	3886485.5	143925.8	
M1114	27	16:51:26.0	16:51:28.2	00:02.2	27	+	3886483.9	144070.0	
M1115	27	16:52:41.7	16:52:57.6	00:15.9	140	D	3886479.4	144810.7	
M1116	27	16:53:47.5	16:53:48.6	00:01.1	45	-	3886472.6	145296.0	
M1117	27	16:54:14.4	16:54:16.0	00:01.6	20	-	3886469.3	145527.2	
M1118	27	16:55:30.6	16:55:32.7	00:02.1	22	+	3886460.3	146169.3	
M1119	27	16:55:36.1	16:55:38.8	00:02.7	42	-	3886459.7	146215.7	
M1120	27	16:55:48.6	16:55:49.7	00:01.1	22	-	3886458.2	146317.2	
M1121	27	16:55:52.0	16:55:54.2	00:02.2	29	+	3886457.7	146350.0	
M1122	27	16:56:45.1	16:56:48.4	00:03.3	47	+	3886451.4	146802.5	
M1123	27	16:57:12.5	16:57:14.7	00:02.2	65	+	3886448.3	147028.6	
M1124	27	16:57:14.7	16:57:16.4	00:01.7	45	+	3886448.0	147047.1	
M1125	27	16:57:41.6	16:57:42.7	00:01.1	52	+	3886444.8	147273.9	
M1126	27	16:58:00.8	16:58:03.0	00:02.2	35	D	3886442.5	147435.6	
M1127	27	17:01:23.1	17:01:25.3	00:02.2	102	+	3886423.1	149107.6	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M1128	27	17:01:56.5	17:01:58.1	00:01.6	72	+	3886420.4	149376.2	
M1129	27	17:02:25.0	17:02:26.0	00:01.0	98	-	3886418.1	149617.8	
M1130	27	17:02:56.6	17:02:58.3	00:01.7	139	+	3886415.5	149868.4	
M1131	27	17:03:43.7	17:03:45.3	00:01.6	49	+	3886411.6	150253.5	
M1132	27	17:04:04.5	17:04:06.7	00:02.2	37	+	3886409.9	150423.6	
M1133	27	17:04:06.7	17:04:08.3	00:01.6	52	+	3886409.7	150441.5	
M1134	27	17:04:19.8	17:04:22.0	00:02.2	56	+	3886408.6	150548.7	
M1135	27	17:05:05.8	17:05:08.0	00:02.2	60	+	3886404.8	150924.8	
M1136	27	17:06:03.4	17:06:05.1	00:01.7	32	+	3886384.1	151403.0	
M1137	27	17:06:07.8	17:06:11.1	00:03.3	36	D	3886382.1	151448.6	
M1138	28	17:08:15.5	17:08:17.7	00:02.2	57	D	3886251.5	151493.7	A29
M1139	28	17:10:27.7	17:10:28.8	00:01.1	20	+	3886281.8	150070.6	
M1140	28	17:13:18.5	17:13:20.2	00:01.7	49	+	3886313.4	148293.9	
M1141	28	17:13:27.8	17:13:30.0	00:02.2	23	-	3886315.0	148215.9	
M1142	28	17:14:13.9	17:14:15.0	00:01.1	21	+	3886323.1	147746.1	
M1143	28	17:19:02.7	17:19:04.9	00:02.2	39	D	3886374.1	144802.7	
M1144	28	17:20:42.4	17:20:44.6	00:02.2	20	+	3886391.7	143785.6	
M1145	28	17:21:35.1	17:21:52.7	00:17.6	140	D	3886402.5	143159.4	
M1146	28	17:29:31.4	17:29:34.7	00:03.3	28	D	3886479.6	138399.8	
M1147	28	17:30:21.1	17:30:22.8	00:01.7	36	+	3886485.6	137936.0	
M1148	28	17:32:21.0	17:32:23.7	00:02.7	20	-	3886500.8	136759.3	
M1149	28	17:33:36.0	17:33:37.7	00:01.7	65	+	3886510.6	136021.6	
M1150	28	17:34:32.6	17:34:34.2	00:01.6	30	+	3886520.4	135485.9	
M1151	28	17:36:04.1	17:36:07.9	00:03.8	23	-	3886536.4	134618.6	
M1152	28	17:37:56.9	17:37:59.6	00:02.7	21	-	3886556.0	133549.8	
M1153	28	17:39:17.3	17:39:19.0	00:01.7	26	-	3886570.0	132787.4	
M1154	28	17:39:51.3	17:39:54.0	00:02.7	20	-	3886576.0	132465.3	
M1155	29	17:41:36.1	17:41:37.8	00:01.7	30	-	3886439.5	132331.7	
M1156	29	17:41:49.9	17:41:51.0	00:01.1	66	+	3886439.0	132449.8	
M1157	29	17:41:54.8	17:41:55.9	00:01.1	25	+	3886438.8	132492.3	
M1158	29	17:41:58.1	17:41:59.7	00:01.6	22	-	3886438.7	132520.3	
M1159	29	17:42:08.5	17:42:09.6	00:01.1	23	+	3886438.3	132610.0	
M1160	29	17:42:28.2	17:42:29.9	00:01.7	36	+	3886437.6	132779.6	
M1161	29	17:42:30.4	17:42:31.5	00:01.1	62	+	3886437.5	132798.5	
M1162	29	17:42:46.8	17:42:47.9	00:01.1	20	+	3886433.6	132934.4	
M1163	29	17:42:57.8	17:42:59.4	00:01.6	20	+	3886422.3	133011.8	
M1164	29	17:43:02.2	17:43:03.3	00:01.1	48	+	3886417.8	133042.9	
M1165	29	17:43:30.7	17:43:31.8	00:01.1	27	-	3886388.4	133244.9	
M1166	30	09:52:59.6	09:53:08.3	00:08.7	48	MC	3886077.8	150768.1	
M1167	30	09:54:02.5	09:54:12.3	00:09.8	221	D	3886093.7	150112.4	
M1168	30	09:55:21.3	09:55:23.0	00:01.7	37	+	3886108.5	149392.0	
M1169	30	09:55:38.8	09:55:40.5	00:01.7	25	+	3886110.7	149212.6	
M1170	30	09:58:16.0	09:58:19.3	00:03.3	29	MC	3886132.3	147595.1	
M1171	30	10:01:24.9	10:01:27.1	00:02.2	22	-	3886164.1	145711.4	
M1172	30	10:01:41.4	10:01:42.5	00:01.1	29	+	3886167.8	145549.8	
M1173	30	10:01:43.6	10:01:45.3	00:01.7	21	+	3886168.3	145528.3	
M1174	30	10:02:40.0	10:02:43.8	00:03.8	27	-	3886181.4	144978.6	
M1175	30	10:11:36.8	10:11:38.5	00:01.7	28	+	3886189.0	143030.9	
M1176	30	10:14:27.9	10:14:29.0	00:01.1	22	-	3886215.6	141236.2	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M1177	30	10:16:07.1	10:16:08.2	00:01.1	683	-	3886231.5	140196.4	
M1178	30	10:18:26.1	10:18:28.3	00:02.2	21	-	3886253.8	138740.1	
M1179	30	10:22:28.9	10:22:31.0	00:02.1	30	+	3886296.6	136199.4	
M1180	30	10:24:37.1	10:24:38.7	00:01.6	38	-	3886322.0	134861.1	
M1181	30	10:24:43.6	10:24:45.3	00:01.7	59	+	3886323.3	134792.3	
M1182	30	17:45:46.1	17:45:48.3	00:02.2	40	+	3886327.8	133353.3	
M1183	30	17:46:08.5	17:46:10.2	00:01.7	84	+	3886326.9	133577.0	
M1184	30	17:46:26.1	17:46:27.2	00:01.1	38	+	3886326.2	133751.8	
M1185	30	17:46:34.3	17:46:36.5	00:02.2	41	-	3886325.9	133833.5	
M1186	30	17:46:54.5	17:46:56.2	00:01.7	41	+	3886325.0	134035.3	
M1187	30	17:47:07.1	17:47:09.9	00:02.8	47	-	3886324.5	134160.9	
M1188	30	17:48:31.1	17:48:34.4	00:03.3	24	+	3886321.1	134998.0	
M1189	30	17:48:38.2	17:48:39.3	00:01.1	72	+	3886320.8	135068.8	
M1190	30	17:48:40.4	17:48:42.6	00:02.2	81	+	3886320.7	135090.7	
M1191	30	17:48:47.5	17:48:49.2	00:01.7	31	+	3886320.4	135161.9	
M1192	30	17:50:10.4	17:50:13.7	00:03.3	49	-	3886317.0	135987.6	
M1193	30	17:50:39.4	17:50:40.6	00:01.2	30	+	3886315.8	136277.6	
M1194	30	17:51:37.0	17:51:38.1	00:01.1	56	-	3886310.9	136855.4	
M1195	30	17:52:01.2	17:52:03.3	00:02.1	44	D	3886306.6	137116.9	
M1196	30	17:56:00.3	17:56:03.0	00:02.7	40	-	3886266.8	139519.0	
M1197	30	17:56:11.8	17:56:12.9	00:01.1	40	+	3886264.9	139633.3	
M1198	30	17:56:40.9	17:56:42.5	00:01.6	52	-	3886260.1	139922.0	
M1199	30	17:57:26.9	17:57:30.3	00:03.4	37	D	3886252.1	140402.0	
M1200	30	17:57:34.6	17:57:37.4	00:02.8	37	+	3886251.2	140456.2	
M1201	30	17:58:44.2	17:58:45.8	00:01.6	26	+	3886234.9	141148.3	
M1202	30	17:59:11.6	17:59:14.3	00:02.7	28	+	3886227.0	141420.9	
M1203	30	18:00:41.1	18:00:43.2	00:02.1	27	-	3886212.1	142310.1	
M1204	30	18:00:45.4	18:00:48.7	00:03.3	32	MC	3886211.5	142369.7	
M1205	30	18:01:01.9	18:01:06.3	00:04.4	28	D	3886209.8	142538.8	
M1206	30	18:02:17.6	18:02:18.7	00:01.1	66	-	3886202.2	143268.2	
M1207	30	18:03:47.0	18:03:48.1	00:01.1	39	+	3886189.7	144119.0	
M1208	30	18:05:24.0	18:05:25.7	00:01.7	64	-	3886174.4	145022.9	
M1209	30	18:05:35.0	18:05:36.1	00:01.1	97	+	3886172.6	145125.3	
M1210	30	18:06:22.2	18:06:23.8	00:01.6	131	+	3886165.2	145564.4	
M1211	30	18:08:29.3	18:08:31.5	00:02.2	22	-	3886145.1	146748.9	
M1212	30	18:09:07.6	18:09:10.3	00:02.7	22	+	3886139.1	147105.4	
M1213	30	18:10:32.7	18:10:34.9	00:02.2	66	+	3886127.4	147867.8	
M1214	30	18:10:35.4	18:10:37.6	00:02.2	49	-	3886127.1	147891.5	
M1215	30	18:10:45.8	18:10:47.5	00:01.7	37	+	3886125.8	147981.4	
M1216	30	18:11:47.8	18:11:48.9	00:01.1	28	-	3886118.4	148517.5	
M1217	30	18:12:05.4	18:12:07.6	00:02.2	33	-	3886116.3	148669.3	
M1218	30	18:12:58.9	18:13:02.8	00:03.9	39	D	3886109.5	149156.5	
M1219	30	18:14:21.1	18:14:25.0	00:03.9	66	+	3886100.0	149843.8	
M1220	30	18:14:46.9	18:14:53.4	00:06.5	123	-	3886096.9	150066.4	
M1221	30	18:16:28.4	18:16:29.5	00:01.1	22	+	3886084.7	150944.6	
M1222	31	10:35:51.0	10:35:53.8	00:02.8	38	D	3886251.7	134504.7	
M1223	31	10:36:07.0	10:36:08.1	00:01.1	20	+	3886249.5	134628.3	
M1224	31	10:36:20.1	10:36:23.4	00:03.3	32	-	3886247.5	134737.7	
M1225	31	10:38:15.2	10:38:16.3	00:01.1	79	+	3886230.3	135696.2	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M1226	31	10:39:02.2	10:39:04.4	00:02.2	50	-	3886223.2	136087.7	
M1227	31	10:39:10.5	10:39:12.1	00:01.6	27	-	3886222.0	136156.4	
M1228	31	10:39:17.1	10:39:19.8	00:02.7	30	+	3886221.0	136211.0	
M1229	31	10:40:02.4	10:40:04.6	00:02.2	48	+	3886214.2	136588.8	
M1230	31	10:40:38.1	10:40:41.4	00:03.3	30	-	3886208.9	136885.5	
M1231	31	10:41:10.8	10:41:13.0	00:02.2	54	+	3886203.9	137158.5	
M1232	31	10:41:44.8	10:41:47.0	00:02.2	21	-	3886198.9	137441.0	
M1233	31	10:41:49.2	10:41:51.4	00:02.2	22	-	3886198.2	137477.6	
M1234	31	10:42:19.3	10:42:21.0	00:01.7	41	+	3886193.7	137728.6	
M1235	31	10:42:30.8	10:42:32.5	00:01.7	46	+	3886192.0	137824.3	
M1236	31	10:42:37.4	10:42:40.2	00:02.8	69	D	3886190.6	137897.6	
M1237	31	10:44:01.9	10:44:05.2	00:03.3	47	D	3886178.0	138600.9	
M1238	31	10:45:17.5	10:45:20.8	00:03.3	46	D	3886166.7	139225.6	
M1239	31	10:45:50.9	10:45:52.5	00:01.6	77	+	3886162.0	139490.2	
M1240	31	10:46:29.2	10:46:30.8	00:01.6	32	-	3886156.2	139809.0	
M1241	31	10:47:11.5	10:47:15.3	00:03.8	42	-	3886149.9	140161.1	
M1242	31	10:47:20.2	10:47:21.9	00:01.7	54	-	3886148.6	140233.9	
M1243	31	10:49:40.0	10:49:41.6	00:01.6	44	+	3886127.6	141398.0	
M1244	31	10:49:52.6	10:49:53.7	00:01.1	49	-	3886125.8	141502.5	
M1245	31	10:53:26.7	10:53:27.2	00:00.5	42	+	3886093.7	143285.2	
M1246	31	10:53:46.9	10:53:48.5	00:01.6	51	+	3886090.7	143453.2	
M1247	31	10:55:53.4	10:55:56.7	00:03.3	32	-	3886073.5	144528.5	
M1248	31	10:56:51.6	10:56:54.9	00:03.3	24	D	3886067.0	145055.1	
M1249	31	11:00:02.6	11:00:06.4	00:03.8	25	-	3886046.1	146721.0	
M1250	31	11:00:59.6	11:01:00.7	00:01.1	35	+	3886039.8	147222.4	
M1251	31	11:01:14.9	11:01:17.6	00:02.7	31	-	3886038.1	147357.4	
M1252	31	11:02:53.0	11:02:56.9	00:03.9	23	-	3886027.3	148220.9	
M1253	31	11:03:48.3	11:03:49.9	00:01.6	24	+	3886021.2	148707.3	
M1254	31	11:06:25.6	11:06:29.4	00:03.8	35	+	3885996.3	150105.9	
M1255	31	11:06:50.8	11:06:54.1	00:03.3	29	D	3885991.8	150350.0	
M1256	32	11:11:21.1	11:11:29.3	00:08.2	50	D	3885846.7	151637.6	
M1257	32	11:14:11.4	11:14:15.9	00:04.5	23	D	3885857.1	150054.3	
M1258	32	11:14:24.6	11:14:26.8	00:02.2	24	-	3885857.8	149956.5	
M1259	32	11:15:46.8	11:15:47.9	00:01.1	43	+	3885862.8	149182.8	
M1260	32	11:15:56.1	11:15:58.9	00:02.8	27	-	3885863.4	149095.3	
M1261	32	11:18:34.5	11:18:36.1	00:01.6	24	-	3885873.2	147604.9	
M1262	32	11:18:46.6	11:18:47.7	00:01.1	24	+	3885873.9	147491.4	
M1263	32	11:20:14.7	11:20:15.8	00:01.1	33	-	3885879.4	146661.9	
M1264	32	11:20:17.5	11:20:20.2	00:02.7	30	D	3885879.6	146626.1	
M1265	32	11:23:01.3	11:23:02.9	00:01.6	26	+	3885889.6	145094.6	
M1266	32	11:23:47.2	11:23:50.0	00:02.8	31	+	3885892.5	144662.0	
M1267	32	11:23:51.1	11:23:53.3	00:02.2	38	-	3885892.7	144625.8	
M1268	32	11:23:58.8	11:24:00.4	00:01.6	21	-	3885893.2	144553.3	
M1269	32	11:24:14.8	11:24:15.9	00:01.1	30	-	3885894.2	144402.7	
M1270	32	11:24:40.5	11:24:46.0	00:05.5	92	D	3885895.7	144161.0	
M1271	32	11:25:01.4	11:25:02.5	00:01.1	23	-	3885897.0	143964.4	
M1272	32	11:25:08.5	11:25:09.6	00:01.1	2O	+	3885897.5	143897.6	
M1273	32	11:25:14.5	11:25:16.7	00:02.2	26	D	3885897.9	143830.8	
M1274	32	11:25:22.2	11:25:23.3	00:01.1	45	+	3885898.3	143768.7	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M1275	32	11:30:46.9	11:30:49.1	00:02.2	20	D	3885984.4	143881.7	
M1276	32	11:34:42.4	11:34:44.0	00:01.6	65	-	3886010.0	142055.9	
M1277	32	11:34:48.5	11:34:49.6	00:01.1	26	+	3886011.4	142003.5	
M1278	32	11:34:59.4	11:35:00.5	00:01.1	55	+	3886013.9	141908.9	
M1279	32	11:37:36.1	11:37:37.7	00:01.6	26	+	3886049.9	140552.7	
M1280	32	11:37:39.4	11:37:41.0	00:01.6	25	+	3886050.4	140522.4	
M1281	32	11:38:44.0	11:38:45.1	00:01.1	29	+	3886060.3	139928.4	
M1282	32	11:41:21.7	11:41:23.3	00:01.6	43	+	3886084.3	138479.3	
M1283	32	11:41:43.0	11:41:44.1	00:01.1	47	+	3886087.5	138283.1	
M1284	32	11:42:32.3	11:42:33.4	00:01.1	20	+	3886095.0	137830.1	
M1285	32	11:43:43.6	11:43:45.2	00:01.6	24	+	3886105.9	137175.5	
M1286	32	11:43:55.0	11:43:58.3	00:03.3	20	-	3886107.6	137069.9	
M1287	32	11:44:07.1	11:44:08.7	00:01.6	40	+	3886109.2	136958.8	
M1288	32	11:45:24.9	11:45:26.6	00:01.7	85	+	3886118.2	136238.2	
M1289	32	11:45:35.3	11:45:36.4	00:01.1	23	+	3886119.5	136142.1	
M1290	32	11:46:13.6	11:46:15.8	00:02.2	34	-	3886127.4	135790.0	
M1291	32	11:48:18.5	11:48:20.2	00:01.7	23	D	3886153.1	134631.1	
M1292	32	11:48:27.8	11:48:30.5	00:02.7	26	D	3886155.1	134339.5	
M1293	32	11:48:51.4	11:48:52.5	00:01.1	24	+	3886160.2	134339.5	
M1294	32	11:49:02.9	11:49:05.7	00:02.8	21	D	3886163.2	134218.4	
M1295	32	11:49:45.2	11:49:46.8	00:01.6	21	+	3886172.3	133846.2	
M1296	32	11:49:58.8	11:49:59.9	00:01.1	24	D	3886175.5	133716.0	
M1297	32	11:50:12.0	11:50:13.1	00:01.1	49	-	3886178.3	133600.5	
M1298	32	11:51:19.4	11:51:20.5	00:01.1	46	+	3886193.5	132981.5	
M1299	32	11:51:39.2	11:51:40.8	00:01.6	80	+	3886197.9	132800.6	
M1300	32	11:52:14.8	11:52:18.1	00:03.3	35	D	3886206.2	132463.5	
M1301	33	12:00:08.2	12:00:09.3	00:01.1	49	-	3886066.8	132526.8	
M1302	33	12:00:28.5	12:00:30.1	00:01.6	35	+	3886067.6	132696.9	
M1303	33	12:00:36.7	12:00:38.3	00:01.6	21	D	3886068.7	132771.1	
M1304	33	12:01:34.2	12:01:36.4	00:02.2	22	D	3886068.8	133265.7	
M1305	33	12:01:41.3	12:01:42.4	00:01.1	61	-	3886065.2	133323.2	
M1306	33	12:02:26.8	12:02:28.5	00:01.7	25	-	3886044.2	133756.7	
M1307	33	12:02:58.6	12:03:00.3	00:01.7	24	+	3886052.2	134064.0	
M1308	33	12:09:27.9	12:09:28.5	00:00.6	24	+	3886041.5	134764.8	
M1309	33	12:10:25.0	12:10:27.2	00:02.2	22	+	3886025.4	135306.3	
M1310	33	12:12:06.3	12:12:09.1	00:02.8	34	D	3886001.7	136270.4	
M1311	33	12:13:38.4	12:13:40.6	00:02.2	2O	-	3885989.8	137096.5	
M1312	33	12:14:08.5	12:14:10.2	00:01.7	21	-	3885987.4	137368.0	
M1313	33	12:19:56.5	12:19:59.8	00:03.3	22	D	3885945.9	140522.1	
M1314	33	12:21:25.8	12:21:29.0	00:03.2	23	D	3885931.7	141327.4	
M1315	33	12:21:59.2	12:22:01.4	00:02.2	21	D	3885926.5	141624.7	
M1316	33	12:22:32.6	12:22:33.7	00:01.1	22	+	3885921.4	141915.9	
M1317	33	12:25:22.5	12:25:32.9	00:10.4	31	-	3885894.5	143468.1	
M1318	33	12:26:02.5	12:26:04.1	00:01.6	31	+	3885888.1	143833.5	
M1319	33	12:27:38.3	12:27:41.6	00:03.3	22	-	3885872.9	144709.7	
M1320	33	12:31:34.0	12:31:36.1	00:02.1	24	-	3885846.5	146810.7	
M1321	33	12:33:03.3	12:33:06.1	00:02.8	23	-	3885837.1	147604.1	
M1322	33	12:34:15.0	12:34:17.3	00:02.3	21	+	3885829.6	148241.2	
M1323	33	12:40:31.8	12:40:40.1	00:08.3	51	-	3885790.0	151587.4	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M1324	34	12:42:53.2	12:43:09.1	00:15.9	224	+	3885637.0	151578.8	
M1325	34	12:43:59.5	12:44:06.1	00:06.6	30	D	3885655.0	150881.6	A34
M1326	34	12:46:47.3	12:46:51.1	00:03.8	22	D	3885691.8	149275.8	
M1327	34	12:49:23.6	12:49:25.8	00:02.2	94	-	3885722.6	147783.2	
M1328	34	13:04:12.8	13:04:14.4	00:01.6	24	+	3885852.5	139505.0	
M1329	34	13:09:23.8	13:09:26.5	00:02.7	27	D	3885904.6	136617.7	
M1330	34	13:15:43.1	13:15:44.7	00:01.6	21	D	3885955.3	133003.8	
M1331	35	13:27:05.7	13:27:07.8	00:02.1	76	-	3885908.2	132692.8	
M1332	35	13:27:40.7	13:27:42.9	00:02.2	39	-	3885905.5	133002.0	
M1333	35	13:28:34.4	13:28:35.5	00:01.1	30	-	3885901.5	133475.5	
M1334	35	13:28:40.4	13:28:43.1	00:02.7	43	-	3885901.0	133528.4	
M1335	35	13:28:46.4	13:28:48.1	00:01.7	27	-	3885900.5	133581.8	
M1336	35	13:29:07.8	13:29:08.9	00:01.1	42	+	3885898.9	133770.0	
M1337	35	13:30:44.7	13:30:46.4	00:01.7	40	-	3885891.5	134625.5	
M1338	35	13:33:55.2	13:33:57.4	00:02.2	35	+	3885877.1	136305.8	
M1339	35	13:36:41.7	13:36:42.8	00:01.1	38	+	3885864.4	137774.6	
M1340	35	13:42:43.5	13:42:44.6	00:01.1	23	+	3885836.9	140966.4	
M1341	35	13:46:49.7	13:46:51.4	00:01.7	26	+	3885818.2	143138.7	
M1342	35	13:47:23.1	13:47:25.3	00:02.2	64	+	3885815.7	143433.2	
M1343	35	13:47:57.6	13:48:01.4	00:03.8	48	D	3885813.0	143752.5	
M1344	35	13:49:18.2	13:49:21.5	00:03.3	32	+	3885807.0	144448.8	
M1345	35	13:50:32.1	13:50:33.3	00:01.2	50	+	3885801.3	145101.0	
M1346	35	13:52:02.7	13:52:05.5	00:02.8	25	+	3885794.5	145900.1	
M1347	35	13:52:33.5	13:52:36.2	00:02.7	39	-	3885792.1	146171.3	
M1348	35	13:53:08.6	13:53:10.2	00:01.6	20	-	3885789.5	146481.0	
M1349	35	13:53:44.2	13:53:45.9	00:01.7	22	+	3885786.8	146795.4	
M1350	35	13:55:16.8	13:55:19.0	00:02.2	21	-	3885779.7	147612.0	
M1351	35	13:55:40.3	13:55:43.1	00:02.8	30	D	3885777.8	147829.4	
M1352	35	14:15:40.5	14:15:50.3	00:09.8	274	D	3885557.8	151456.0	
M1353	35	14:16:50.0	14:16:54.4	00:04.4	22	-	3885560.1	150952.0	A35
M1354	35	14:19:13.1	14:19:14.8	00:01.7	21	+	3885582.5	149764.5	A36
M1355	35	14:19:47.2	14:19:48.3	00:01.1	22	-	3885591.1	149473.8	
M1356	35	14:21:54.3	14:21:57.0	00:02.7	23	-	3885611.1	148396.0	
M1357	35	14:22:17.3	14:22:20.6	00:03.3	30	D	3885613.1	148193.0	
M1358	35	14:23:05.6	14:23:07.2	00:01.6	58	-	3885613.6	147774.3	
M1359	35	14:23:11.0	14:23:13.2	00:02.2	44	+	3885614.0	147721.8	
M1360	35	14:24:07.0	14:24:09.2	00:02.2	55	+	3885621.7	147170.9	
M1361	35	14:24:37.7	14:24:38.8	00:01.1	29	-	3885627.7	146862.3	
M1362	35	14:24:54.7	14:24:56.9	00:02.2	21	+	3885631.0	146691.3	
M1363	36	14:40:27.5	14:40:41.2	00:13.7	351	-	3885450.8	151275.8	A37
M1364	36	14:41:18.5	14:41:20.1	00:01.6	45	-	3885461.8	150761.7	
M1365	36	15:03:43.7	15:03:45.3	00:01.6	23	+	3885682.4	138057.4	
M1366	36	15:08:26.5	15:08:28.7	00:02.2	27	D	3885729.9	135277.8	
M1367	36	15:12:28.8	15:12:29.9	00:01.1	59	+	3885771.6	132896.2	
M1368	36	15:12:35.9	15:12:37.0	00:01.1	33	-	3885772.3	132825.4	
M1369	36	15:12:52.3	15:12:53.4	00:01.1	20	-	3885787.7	132667.8	
M1370	37	15:48:46.0	15:48:48.7	00:02.7	20	-	3885552.1	137936.5	
M1371	37	15:49:51.3	15:49:53.0	00:01.7	57	+	3885540.0	138506.5	
M1372	37	15:50:23.6	15:50:24.7	00:01.1	44	-	3885541.9	138797.5	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M1373	37	15:52:08.7	15:52:09.8	00:01.1	24	+	3885548.2	139744.9	
M1374	37	15:52:56.3	15:52:58.5	00:02.2	26	D	3885551.0	140179.1	
M1375	37	15:53:56.0	15:53:57.1	00:01.1	21	-	3885554.5	140712.2	
M1376	37	15:54:19.1	15:54:20.2	00:01.1	26	-	3885555.9	140919.9	
M1377	37	15:55:13.4	15:55:15.6	00:02.2	21	-	3885553.4	141401.2	
M1378	37	16:06:45.5	16:06:47.7	00:02.2	22	D	3885411.0	146395.8	
M1379	37	16:10:57.1	16:11:29.4	00:32.3	673	+	3885434.6	148250.5	
M1380	37	16:11:38.7	16:11:39.8	00:01.1	51	+	3885429.4	148565.8	
M1381	37	16:12:47.6	16:12:49.3	00:01.7	32	+	3885410.3	149107.6	
M1382	37	16:14:05.6	16:14:08.9	00:03.3	34	+	3885389.8	149721.7	
M1383	37	16:15:41.0	16:15:42.6	00:01.6	22	+	3885370.3	150477.1	
M1384	37	16:16:31.9	16:16:33.0	00:01.1	26	+	3885351.9	150887.8	
M1385	37	16:17:23.5	16:17:34.5	00:11.0	245	+	3885333.4	151304.2	
M1386	37	16:17:54.7	16:17:55.8	00:01.1	25	-	3885322.1	151556.5	
M1387	38	16:20:39.3	16:20:51.9	00:12.6	564	+	3885274.7	151283.3	
M1388	38	16:21:35.2	16:21:36.8	00:01.6	48	+	3885274.9	150801.4	A41
M1389	38	16:21:40.6	16:21:42.8	00:02.2	39	+	3885274.9	150754.4	A42
M1390	38	16:21:45.0	16:21:48.3	00:03.3	36	D	3885274.9	150716.5	
M1391	38	16:22:21.7	16:22:23.9	00:02.2	22	D	3885275.4	150398.4	
M1392	38	16:22:54.1	16:22:56.8	00:02.7	23	-	3885278.9	150099.7	
M1393	38	16:26:30.4	16:26:52.4	00:22.0	897	+	3885307.3	148071.8	
M1394	38	16:27:14.9	16:27:16.0	00:01.1	31	+	3885314.3	147647.5	
M1395	38	16:32:44.5	16:32:47.2	00:02.7	27	D	3885369.9	144410.5	
M1396	38	16:33:22.2	16:33:27.1	00:04.9	21	-	3885376.7	144022.3	
M1397	38	16:33:50.7	16:33:52.3	00:01.6	25	-	3885380.3	143731.7	
M1398	38	16:34:16.4	16:34:30.7	00:14.3	77	D	3885384.3	143417.7	
M1399	38	16:35:25.0	16:35:32.1	00:07.1	27	+	3885392.4	142768.0	
M1400	38	16:38:00.6	16:38:01.7	00:01.1	28	+	3885412.4	141177.5	
M1401	38	16:38:31.9	16:38:33.6	00:01.7	22	-	3885416.9	140869.2	
M1402	38	16:40:28.2	16:40:30.9	00:02.7	26	D	3885437.9	139722.7	
M1403	38	16:40:46.2	16:40:47.9	00:01.7	22	+	3885441.0	139557.6	
M1404	38	16:41:19.1	16:41:23.0	00:03.9	41	-	3885446.9	139237.8	
M1405	38	16:42:52.2	16:42:53.3	00:01.1	64	+	3885463.5	138333.1	
M1406	38	16:46:05.6	16:46:07.3	00:01.7	40	+	3885499.9	136470.7	
M1407	38	16:47:48.1	16:47:50.8	00:02.7	29	D	3885516.8	135494.2	
M1408	38	16:47:53.0	16:47:55.8	00:02.8	25	D	3885517.6	135447.0	
M1409	38	16:48:41.8	16:48:44.6	00:02.8	62	+	3885525.1	134998.9	
M1410	38	16:49:38.3	16:49:39.4	00:01.1	30	-	3885534.0	134467.9	
M1411	38	16:53:21.2	16:53:22.9	00:01.7	28	+	3885569.0	132370.0	
M1412	39	16:56:39.1	16:56:40.2	00:01.1	28	+	3885473.7	132665.1	
M1413	39	16:57:39.9	16:57:41.6	00:01.7	29	+	3885466.5	133085.6	
M1414	39	16:59:23.6	16:59:26.4	00:02.8	25	D	3885454.1	133815.7	
M1415	39	17:01:09.4	17:01:11.1	00:01.7	20	D	3885445.2	134660.1	
M1416	39	17:03:34.0	17:03:36.8	00:02.8	28	+	3885432.7	135832.3	
M1417	39	17:05:28.5	17:05:32.9	00:04.4	27	D	3885417.9	136769.5	
M1418	39	17:07:44.3	17:07:50.4	00:06.1	21	D	3885399.8	137899.3	
M1419	39	17:08:25.4	17:08:29.2	00:03.8	20	D	3885394.4	138235[illegible]	
M1420	39	17:08:46.8	17:08:50.0	00:03.2	22	D	3885391.8	138396[illegible]	
M1421	39	17:14:44.4	17:14:46.6	00:02.2	46	D	3885337.0	141335.1	
M1422	39	17:20:55.3	17:20:57.5	00:02.2	38	-	3885279.4	144286.8	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M1423	39	17:21:50.1	17:21:51.7	00:01.6	21	+	3885271.8	144712.4	
M1424	39	17:23:48.0	17:23:49.1	00:01.1	42	-	3885255.3	145629.3	
M1425	39	17:25:16.8	17:25:18.4	00:01.6	28	+	3885243.0	146319.6	
M1426	39	17:30:52.2	17:30:56.5	00:04.3	38	+	3885192.7	148933.8	
M1427	39	17:31:43.6	17:31:45.2	00:01.6	27	-	3885184.9	149334.8	
M1428	39	17:35:11.3	17:35:36.0	00:24.7	355	MC	3885151.7	151031.9	
M1429	40A	09:43:19.5	09:43:21.7	00:02.2	44	-	3885056.6	151572.7	
M1430	40A	09:43:42.0	09:43:49.7	00:07.7	22	+	3885072.7	151275.5	
M1431	40A	09:44:25.4	09:44:51.1	00:25.7	455	D	3885065.7	150727.4	
M1432	40A	09:44:54.9	09:45:08.1	00:13.2	28	+	3885077.3	150528.1	A45
M1433	40A	09:45:08.6	09:45:10.8	00:02.2	16	-	3885082.6	150437.0	
M1434	40A	09:46:07.8	09:46:11.1	00:03.3	8	-	3885084.6	149782.5	
M1435	40A	09:46:13.9	09:46:20.9	00:07.0	12	MC	3885083.9	149704.5	
M1436	40A	09:46:47.9	09:46:51.7	00:03.8	24	-	3885080.6	149354.5	
M1437	40A	09:46:53.9	09:46:58.3	00:04.4	11	D	3885079.9	149282.5	
M1438	40A	09:47:18.1	09:47:25.3	00:07.2	14	MC	3885087.3	149012.7	
M1439	40A	09:47:28.0	09:47:30.2	00:02.2	31	-	3885089.9	148928.8	
M1440	40A	09:47:40.6	09:47:50.4	00:09.8	27	MC	3885094.9	148770.0	
M1441	40A	09:47:53.2	09:48:02.5	00:09.3	13	MC	3885098.9	148641.9	
M1442	40A	09:48:06.3	09:48:09.6	00:03.3	15	D	3885102.9	148513.7	
M1443	40A	09:48:22.8	09:48:25.5	00:02.7	12	-	3885105.6	148334.5	
M1444	40A	09:48:52.5	09:48:56.3	00:03.8	15	+	3885106.2	148029.3	
M1445	40A	09:49:11.1	09:49:15.0	00:03.9	13	MC	3885106.6	147833.8	
M1446	40A	09:49:28.7	09:49:33.7	00:05.0	23	MC	3885107.0	147650.4	
M1447	40A	09:49:36.9	09:49:41.3	00:04.4	8	D	3885107.2	147553.2	
M1448	40A	09:49:45.1	09:49:50.1	00:05.0	10	MC	3885110.2	147468.2	
M1449	40A	09:50:07.0	09:50:09.8	00:02.8	16	-	3885119.7	147253.0	
M1450	40A	09:50:11.4	09:50:26.2	00:14.8	14	MC	3885123.6	147162.5	
M1451	40A	09:50:31.1	09:50:39.4	00:08.3	11	MC	3885129.3	147032.1	
M1452	40A	09:51:12.2	09:51:14.9	00:02.7	20	D	3885148.4	146583.8	
M1453	40A	09:51:22.6	09:51:27.0	00:04.4	17	MC	3885146.9	146459.9	
M1454	40A	09:51:42.3	09:51:53.3	00:11.0	12	MC	3885144.2	146219.3	
M1455	40A	09:52:49.2	09:52:53.6	00:04.4	15	+	3885153.1	145521.0	
M1456	40A	09:52:59.1	09:53:06.2	00:07.1	53	MC	3885154.8	145433.2	
M1457	40A	09:53:17.2	09:53:19.4	00:02.2	98	+	3885158.5	145245.1	
M1458	40A	09:53:44.7	09:53:48.6	00:03.9	33	+	3885174.2	144950.1	
M1459	40A	09:54:07.2	09:54:13.8	00:06.6	19	MC	3885190.7	144674.0	
M1460	40A	09:54:22.6	09:54:36.9	00:14.3	28	MC	3885201.0	144501.0	
M1461	40A	09:54:49.0	09:54:53.9	00:04.9	68	MC	3885204.8	144245.8	
M1462	40A	09:55:10.3	09:55:14.1	00:03.8	14	MC	3885203.1	144041.4	
M1463	40A	09:55:15.7	09:55:22.4	00:06.7	33	MC	3885201.3	143994.7	
M1464	40A	09:55:24.0	09:55:44.9	00:20.9	19	MC	3885195.8	143852.5	
M1465	40A	09:55:58.6	09:56:03.5	00:04.9	37	+	3885185.2	143517.4	
M1466	40A	09:56:12.8	09:56:16.7	00:03.9	16	MC	3885187.8	143382.7	
M1467	40A	09:56:27.7	09:56:32.6	00:04.9	19	D	3885191.4	143200.5	
M1468	40A	09:56:38.1	09:57:01.1	00:23.0	28	MC	3885195.3	142995.3	
M1469	40A	09:57:43.4	09:57:46.7	00:03.3	15	D	3885208.3	142408.7	
M1470	40A	09:58:25.1	09:58:28.9	00:03.8	13	D	3885213.4	141959.5	
M1471	40A	09:58:39.9	09:58:47.0	00:07.1	23	MC	3885203.0	141771.6	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M1472	40A	09:59:03.9	09:59:10.0	00:06.1	20	-	3885210.3	141529.0	
M1473	40A	09:59:35.2	09:59:45.1	00:09.9	9	MC	3885231.7	141174.5	
M1474	40A	10:00:22.9	10:00:31.6	00:08.7	26	MC	3885222.0	140676.2	
M1475	40A	10:00:42.1	10:00:45.3	00:03.2	22	+	3885229.6	140473.8	
M1476	40A	10:01:17.1	10:01:25.3	00:08.2	31	D	3885246.2	140079.4	
M1477	40A	10:02:08.1	10:02:18.0	00:09.9	28	MC	3885253.8	139475.0	
M1478	40A	10:03:16.0	10:03:18.2	00:02.2	31	-	3885275.7	138795.5	
M1479	40B	10:06:23.4	10:06:26.6	00:03.2	16	D	3885292.5	138408.1	
M1480	40B	10:06:40.9	10:06:44.7	00:03.8	19	MC	3885274.6	138214.4	
M1481	40B	10:06:58.4	10:07:01.2	00:02.8	60	-	3885273.8	138032.2	
M1482	40B	10:07:40.6	10:07:43.9	00:03.3	13	D	3885280.0	137566.6	
M1483	40B	10:07:46.6	10:07:49.4	00:02.8	13	D	3885270.4	137500.8	
M1484	40B	10:07:59.2	10:08:01.4	00:02.2	20	D	3885277.8	137373.2	
M1485	40B	10:08:50.7	10:08:56.1	00:05.4	47	D	3885313.5	136824.1	
M1486	40B	10:09:18.0	10:09:20.2	00:02.2	20	-	3885298.4	136554.4	
M1487	40B	10:09:38.8	10:09:48.7	00:09.9	13	MC	3885327.3	136313.3	
M1488	40B	10:10:05.1	10:10:09.5	00:04.4	16	D	3885320.5	136077.7	
M1489	40B	10:10:48.9	10:10:55.5	00:06.6	14	MC	3885336.5	135607.0	
M1490	40B	10:10:58.8	10:11:01.6	00:02.8	17	MC	3885335.0	135523.0	
M1491	40B	10:11:33.4	10:11:39.9	00:06.5	13	D	3885333.9	135142.8	
M1492	40B	10:11:50.4	10:11:54.2	00:03.8	34	MC	3885327.6	135000.6	
M1493	40B	10:12:10.7	10:12:15.1	00:04.4	18	+	3885346.7	134812.4	
M1494	40B	10:12:32.0	10:12:39.1	00:07.1	11	MC	3885360.2	134549.5	
M1495	40B	10:12:40.2	10:12:42.4	00:02.2	10	-	3885348.2	134488.5	
M1496	40B	10:12:51.2	10:13:01.0	00:09.8	14	MC	3885331.3	134333.1	
M1497	40B	10:13:26.3	10:13:29.5	00:03.2	20	D	3885347.8	134019.5	
M1498	40B	10:14:02.4	10:14:06.3	00:03.9	10	D	3885349.7	133660.8	
M1499	40B	10:14:12.9	10:14:32.6	00:19.7	18	MC	3885375.1	133524.6	
M1500	40B	10:15:08.7	10:15:15.2	00:06.5	27	MC	3885366.4	132985.9	
M1501	40B	10:15:22.9	10:15:29.0	00:06.1	20	MC	3885352.6	132818.3	
M1502	40B	10:15:37.7	10:15:42.1	00:04.4	13	-	3885349.8	132698.6	
M1503	40B	10:16:11.6	10:16:16.6	00:05.0	26	-	3885397.7	132367.9	
M1504	40B	10:16:18.2	10:16:24.3	00:06.1	20	MC	3885383.3	132269.5	
M1505	41	10:19:41.4	10:19:50.2	00:08.8	15	MC	3885254.0	132829.0	
M1506	41	10:19:57.8	10:20:02.8	00:05.0	27	D	3885249.7	132999.9	
M1507	41	10:20:09.3	10:20:14.3	00:05.0	15	MC	3885247.3	133094.0	
M1508	41	10:20:19.2	10:20:24.2	00:05.0	18	D	3885244.5	133203.7	
M1509	41	10:20:26.9	10:20:29.1	00:02.2	10	-	3885243.4	133245.5	
M1510	41	10:20:50.5	10:21:11.3	00:20.8	42	MC	3885240.0	133558.3	
M1511	41	10:21:16.2	10:21:29.9	00:13.7	27	MC	3885245.2	133808.4	
M1512	41	10:22:03.9	10:22:06.1	00:02.2	11	D	3885238.4	134201.4	
M1513	41	10:22:26.4	10:22:34.1	00:07.7	10	MC	3885233.4	134465.4	
M1514	41	10:22:51.7	10:22:59.9	00:08.2	24	MC	3885228.9	134697.0	
M1515	41	10:23:18.6	10:23:37.2	00:18.6	34	MC	3885222.7	135021.8	
M1516	41	10:24:03.1	10:24:06.4	00:03.3	11	-	3885215.1	135418.2	
M1517	41	10:24:08.5	10:24:14.0	00:05.5	14	D	3885214.3	135461.9	
M1518	41	10:24:15.1	10:24:30.5	00:15.4	16	MC	3885212.5	135555.1	
M1519	41	10:24:43.6	10:24:51.3	00:07.7	12	MC	3885207.1	135835.7	
M1520	41	10:25:20.9	10:25:24.7	00:03.8	12	+	3885206.3	136175.2	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M1521	41	10:25:36.2	10:25:43.3	00:07.1	16	MC	3885206.1	136336.2	
M1522	41	10:25:58.7	10:26:02.5	00:03.8	16	MC	3885205.9	136535.8	
M1523	41	10:26:12.4	10:26:29.4	00:17.0	13	MC	3885205.7	136713.0	
M1524	41	10:26:48.5	10:27:25.8	00:37.3	24	MC	3885205.2	137067.7	
M1525	41	10:28:16.8	10:28:28.9	00:12.1	9	D	3885189.1	137927.8	
M1526	41	10:28:37.1	10:28:55.7	00:18.6	18	MC	3885184.3	138102.3	
M1527	41	10:29:27.0	10:29:57.6	00:30.6	13	MC	3885169.9	138620.3	
M1528	41	10:30:33.8	10:30:37.1	00:03.3	15	-	3885155.0	139152.8	
M1529	41	10:31:17.6	10:31:20.9	00:03.3	13	D	3885143.5	139567.8	
M1530	41	10:32:14.0	10:32:32.6	00:18.6	13	MC	3885158.7	140057.2	
M1531	41	10:32:35.9	10:32:39.7	00:03.8	18	D	3885160.2	140260.3	
M1532	41	10:33:24.0	10:33:35.6	00:11.6	23	MC	3885134.4	140740.1	
M1533	41	10:34:20.5	10:34:25.4	00:04.9	16	D	3885112.8	141211.6	
M1534	41	10:34:39.0	10:34:47.2	00:08.2	11	MC	3885112.8	141396.6	
M1535	41	10:34:54.9	10:35:10.8	00:15.9	20	MC	3885112.8	141577.7	
M1536	41	10:35:52.0	10:35:59.7	00:07.7	17	MC	3885112.7	142075.9	
M1537	41	10:36:06.3	10:36:17.2	00:10.9	23	D	3885112.7	142211.5	
M1538	41	10:37:06.6	10:37:13.1	00:06.5	50	D	3885110.3	142777.5	
M1539	41	10:37:57.0	10:38:03.6	00:06.6	23	D	3885105.2	143222.0	
M1540	41	10:38:28.2	10:38:42.0	00:13.8	37	MC	3885106.6	143553.5	
M1541	41	10:39:10.5	10:39:13.8	00:03.3	27	D	3885090.9	143896.9	
M1542	41	10:40:11.4	10:40:14.7	00:03.3	72	+	3885072.7	144463.4	
M1543	41	10:40:26.2	10:40:31.1	00:04.9	35	D	3885069.3	144600.5	
M1544	41	10:40:56.8	10:40:59.0	00:02.2	109	+	3885064.8	144860.1	
M1545	41	10:41:05.0	10:41:07.2	00:02.2	91	-	3885064.4	144938.1	
M1546	41	10:43:04.0	10:43:07.8	00:03.8	27	D	3885070.3	146017.6	
M1547	41	10:43:16.6	10:43:19.8	00:03.2	18	D	3885069.2	146127.1	A46
M1548	41	10:43:22.0	10:43:25.3	00:03.3	16	D	3885068.7	146171.7	
M1549	41	10:43:59.3	10:44:03.7	00:04.4	18	D	3885065.1	146520.8	
M1550	41	10:44:37.6	10:45:04.0	00:26.4	28	MC	3885060.4	146979.6	
M1551	41	10:46:09.1	10:46:14.6	00:05.5	16	MC	3885041.6	147705.7	
M1552	41	10:46:29.4	10:46:39.3	00:09.9	29	MC	3885031.4	147890.5	
M1553	41	10:46:57.9	10:47:07.1	00:09.2	55	MC	3885008.4	148147.7	
M1554	41	10:47:45.0	10:47:47.2	00:02.2	29	+	3885004.5	148548.1	
M1555	41	10:48:25.5	10:48:42.5	00:17.0	133	D	3885007.4	148941.1	
M1556	41	10:48:51.3	10:48:54.6	00:03.3	18	-	3885008.7	149116.7	
M1557	41	10:49:43.8	10:49:53.1	00:09.3	12	MC	3884991.2	149586.2	
M1558	41	10:50:07.9	10:50:28.8	00:20.9	37	MC	3884971.2	149871.8	
M1559	41	10:50:37.5	10:50:44.6	00:07.1	18	MC	3884976.9	150073.7	
M1560	41	10:50:49.6	10:51:19.7	00:30.1	279	MC	3884991.4	150383.0	
M1561	41	10:51:21.3	10:51:58.0	00:36.7	449	MC	3884995.6	150622.0	
M1562	41	10:52:01.3	10:52:03.5	00:02.2	16	D	3885000.1	150871.5	
M1563	41	10:52:16.1	10:52:28.7	00:12.6	23	MC	3884997.2	151046.4	
M1564	41	10:52:35.9	10:52:40.3	00:04.4	9	+	3884994.0	151201.4	
M1565	41	10:53:06.0	10:53:11.5	00:05.5	17	D	3884998.3	151490.0	
M1566	42	10:55:49.8	10:55:53.7	00:03.9	12	D	3884859.1	151564.1	
M1567	42	10:56:08.0	10:56:22.8	00:14.8	21	MC	3884865.2	151376.4	
M1568	42	10:56:26.6	10:56:43.1	00:16.5	28	MC	3884873.8	151110.0	
M1569	42	10:57:19.8	10:57:24.7	00:04.9	15	D	3884883.8	150678.6	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M1570	42	10:58:21.6	10:58:23.8	00:02.2	25	-	3884884.3	150033.0	
M1571	42	10:58:27.7	10:58:48.6	00:20.9	575	-	3884883.6	149908.7	
M1572	42	10:59:28.6	10:59:37.4	00:08.8	41	+	3884880.4	149285.8	
M1573	42	11:00:16.3	11:00:21.3	00:05.0	13	D	3884887.3	148793.9	
M1574	42	11:00:26.7	11:00:28.9	00:02.2	11	D	3884888.6	148700.6	
M1575	42	11:00:50.8	11:00:56.4	00:05.6	14	-	3884893.9	148413.9	
M1576	42	11:01:01.9	11:01:15.1	00:13.2	33	MC	3884897.7	148291.1	
M1577	42	11:02:00.5	11:02:04.3	00:03.8	39	-	3884917.4	147707.1	
M1578	42	11:02:13.1	11:02:34.9	00:21.8	21	MC	3884924.7	147475.0	
M1579	42	11:02:48.6	11:02:51.3	00:02.7	14	D	3884933.3	147203.7	
M1580	42	11:03:14.9	11:03:22.6	00:07.7	12	-	3884943.1	146897.6	
M1581	42	11:03:33.1	11:03:37.5	00:04.4	15	-	3884945.0	146750.4	
M1582	42	11:04:31.8	11:04:37.8	00:06.0	13	MC	3884945.9	146146.0	
M1583	42	11:05:18.8	11:05:45.1	00:26.3	25	MC	3884960.2	145580.8	
M1584	42	11:06:19.6	11:06:32.2	00:12.6	28	MC	3884972.2	145019.4	
M1585	42	11:06:46.0	11:06:50.9	00:04.9	11	-	3884969.6	144732.7	
M1586	42	11:07:24.3	11:07:29.3	00:05.0	19	-	3884970.7	144327.4	
M1587	42	11:08:18.0	11:08:23.0	00:05.0	43	+	3884984.8	143768.3	
M1588	42	11:08:37.2	11:08:55.9	00:18.7	27	MC	3884992.8	143526.2	
M1589	42	11:09:03.0	11:09:10.7	00:07.7	20	MC	3885001.7	143255.1	
M1590	42	11:09:31.5	11:09:45.8	00:14.3	56	MC	3885007.2	142948.8	
M1591	42	11:10:17.0	11:10:19.7	00:02.7	15	D	3884996.7	142510.4	
M1592	42	11:10:41.2	11:10:52.2	00:11.0	24	MC	3884997.7	142207.3	
M1593	42	11:10:55.4	11:10:59.8	00:04.4	18	-	3884998.1	142102.1	
M1594	42	11:11:18.4	11:11:26.1	00:07.7	14	MC	3885005.1	141839.0	
M1595	43	11:29:10.3	11:29:22.9	00:12.6	28	-	3885088.1	132421.2	
M1596	43	11:29:22.9	11:29:43.7	00:20.8	10	MC	3885080.7	132542.3	
M1597	43	11:30:32.4	11:30:36.8	00:04.4	13	MC	3885053.0	133156.8	
M1598	43	11:32:54.2	11:33:06.8	00:12.6	33	MC	3885030.1	134567.4	
M1599	43	11:34:16.8	11:34:24.5	00:07.7	14	-	3885018.6	135293.2	
M1600	43	11:34:34.9	11:34:42.0	00:07.1	24	-	3885020.5	135501.9	
M1601	43	11:37:44.6	11:37:51.2	00:06.6	20	D	3885004.8	137280.1	
M1602	43	11:41:59.6	11:42:06.7	00:07.1	17	D	3884968.1	139637.7	
M1603	43	11:43:38.6	11:43:46.3	00:07.7	16	D	3884946.2	140531.5	
M1604	43	11:46:18.0	11:46:31.7	00:13.7	15	MC	3884918.5	141993.4	
M1605	43	11:47:29.2	11:47:57.8	00:28.6	24	MC	3884901.0	142828.1	
M1606	43	11:48:43.1	11:48:48.6	00:05.5	35	-	3884895.0	143341.6	
M1607	43	11:49:07.2	11:49:11.0	00:03.8	73	D	3884893.5	143557.9	
M1608	43	11:49:48.9	11:49:56.6	00:07.7	19	MC	3884893.4	143945.7	
M1609	43	11:50:41.0	11:50:47.1	00:06.1	22	MC	3884898.3	144399.7	
M1610	43	11:51:17.3	11:51:27.2	00:09.9	26	MC	3884873.0	144766.7	
M1611	43	11:51:39.2	11:51:43.1	00:03.9	31	-	3884860.8	144928.3	
M1612	43	11:52:10.3	11:52:13.1	00:02.8	63	+	3884876.0	145199.8	
M1613	43	11:52:29.5	11:52:38.8	00:09.3	32	MC	3884881.4	145402.4	
M1614	43	11:52:49.8	11:53:00.2	00:10.4	26	MC	3884874.1	145571.8	
M1615	43	11:53:53.9	11:54:20.3	00:26.4	108	MC	3884844.6	146254.4	
M1616	43	11:54:32.4	11:54:37.3	00:04.9	16	D	3884834.2	146494.2	
M1617	43	11:55:51.8	11:56:00.0	00:08.2	13	MC	3884825.5	147202.2	
M1618	43	11:57:27.2	11:57:31.6	00:04.4	19	D	3884827.7	148033.5	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M1619	43	11:58:02.2	11:58:13.8	00:11.6	30	MC	3884836.1	148322.1	
M1620	43	11:59:10.3	11:59:23.9	00:13.6	19	MC	3884795.1	149009.3	
M1621	43	11:59:47.5	12:00:20.5	00:33.0	365	-	3884790.4	149356.2	
M1622	43	12:00:53.9	12:01:18.0	00:24.1	495	-	3884813.1	149920.0	
M1623	43	12:01:28.4	12:01:47.1	00:18.7	21	MC	3884813.4	150133.7	
M1624	43B	12:01:56.9	12:02:06.8	00:09.9	24	MC	3884802.6	150346.2	
M1625	43B	12:06:19.7	12:06:29.0	00:09.3	31	MC	3884785.7	150766.7	A50
M1626	43B	12:06:54.3	12:07:03.6	00:09.3	19	MC	3884782.1	151100.4	
M1627	43B	12:07:23.3	12:07:30.4	00:07.1	16	MC	3884783.2	151311.7	
M1628	43B	12:07:33.1	12:07:35.3	00:02.2	15	D	3884748.1	151390.8	
M1629	43B	12:07:48.0	12:07:52.4	00:04.4	67	+	3884781.7	151505.8	
M1630	43B	12:08:01.1	12:08:05.5	00:04.4	28	D	3884755.1	151636.1	
M1631	44	12:10:56.8	12:11:02.3	00:05.5	28	MC	3884652.3	151399.0	
M1632	44	12:11:08.3	12:11:13.8	00:05.5	11	MC	3884659.2	151109.6	
M1633	44	12:11:30.3	12:11:35.2	00:04.9	18	D	3884665.0	150867.6	
M1634	44	12:11:51.6	12:11:58.7	00:07.1	30	D	3884671.1	150613.9	
M1635	44	12:12:06.4	12:12:15.2	00:08.8	61	MC	3884675.8	150418.9	
M1636	44	12:12:21.8	12:12:27.3	00:05.5	13	MC	3884678.8	150294.3	
M1637	44	12:12:33.3	12:12:39.4	00:06.1	14	MC	3884681.5	150182.2	
M1638	44	12:12:49.8	12:12:54.6	00:04.8	18	MC	3884684.8	150018.4	
M1639	44	12:13:00.1	12:13:02.3	00:02.2	14	-	3884686.9	149908.5	
M1640	44	12:13:34.6	12:13:41.7	00:07.1	24	MC	3884686.6	149500.2	
M1641	44	12:13:47.7	12:13:53.7	00:06.0	16	MC	3884689.0	149357.8	
M1642	44	12:13:54.8	12:14:49.6	00:54.8	478	D	3884692.0	149177.4	
M1643	44	12:14:43.6	12:14:47.4	00:03.8	16	-	3884699.4	148735.3	
M1644	44	12:15:14.2	12:15:22.4	00:08.2	20	D	3884710.6	148368.2	
M1645	44	12:15:25.7	12:15:31.2	00:05.5	17	D	3884714.9	148255.8	
M1646	44	12:15:37.7	12:15:44.3	00:06.6	15	MC	3884720.5	148112.2	
M1647	44	12:15:56.9	12:16:01.3	00:04.4	12	D	3884728.9	147893.7	
M1648	44	12:16:33.6	12:16:40.2	00:06.6	12	MC	3884746.1	147449.6	
M1649	44	12:17:19.1	12:17:21.3	00:02.2	23	+	3884758.3	146960.9	
M1650	44	12:17:38.4	12:18:03.5	00:25.1	33	MC	3884763.9	146712.9	
M1651	44	12:18:52.3	12:18:60.0	00:07.7	32	D	3884773.0	145864.1	
M1652	44	12:19:13.7	12:19:19.7	00:06.0	27	MC	3884773.0	145601.8	
M1653	44	12:19:40.0	12:19:50.4	00:10.4	12	MC	3884772.9	145309.0	
M1654	44	12:19:54.2	12:20:01.9	00:07.7	10	D	3884772.8	145150.4	
M1655	44	12:20:18.2	12:20:25.3	00:07.1	11	MC	3884772.7	144913.9	
M1656	44	12:20:42.8	12:20:45.6	00:02.8	11	-	3884772.6	144663.9	
M1657	44	12:20:47.8	12:20:51.0	00:03.2	12	D	3884772.6	144596.6	
M1658	44	12:20:57.7	12:21:04.3	00:06.6	14	D	3884772.6	144461.7	
M1659	44	12:21:27.3	12:21:30.6	00:03.3	22	D	3884772.4	144161.6	
M1660	44	12:22:20.9	12:22:40.1	00:19.2	28	MC	3884786.0	143434.9	
M1661	44	12:22:42.8	12:23:02.0	00:19.2	14	MC	3884795.4	143206.8	
M1662	44	12:23:06.4	12:23:21.2	00:14.8	14	MC	3884796.6	143176.3	
M1663	44	12:23:06.4	12:23:20.1	00:13.7	39	MC	3884807.3	142916.6	
M1664	44	12:23:50.3	12:24:13.8	00:23.5	14	MC	3884819.5	142448.6	
M1665	44	12:24:14.9	12:24:18.1	00:03.2	21	D	3884822.3	142286.2	
M1666	44	12:24:38.4	12:24:42.8	00:04.4	14	D	3884826.9	142021.2	
M1667	44	12:24:45.5	12:25:00.3	00:14.8	12	MC	3884829.5	141876.5	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M1668	44	12:25:09.6	12:25:25.0	00:15.4	32	MC	3884832.6	141695.6	
M1669	44	12:25:26.7	12:25:33.9	00:07.2	30	D	3884836.7	141465.0	
M1670	44	12:26:11.0	12:26:24.8	00:13.8	15	MC	3884845.8	140940.8	
M1671	44	12:26:58.2	12:27:01.5	00:03.3	26	+	3884853.5	140477.1	
M1672	44	12:27:05.4	12:27:09.8	00:04.4	15	MC	3884853.8	140399.1	
M1673	44	12:27:16.4	12:27:19.6	00:03.2	14	D	3884854.2	140303.9	
M1674	44	12:27:22.4	12:27:25.7	00:03.3	44	D	3884854.5	140244.3	
M1675	44	12:27:31.2	12:27:38.9	00:07.7	15	MC	3884855.1	140090.2	
M1676	44	12:28:27.0	12:28:30.8	00:03.8	13	D	3884857.6	139528.2	
M1677	44	12:28:53.3	12:28:55.4	00:02.1	16	-	3884858.7	139255.6	
M1678	44	12:29:07.5	12:29:11.3	00:03.8	10	D	3884859.4	139095.6	
M1679	44	12:29:22.3	12:29:28.9	00:06.6	18	MC	3884860.1	138923.5	
M1680	44	12:29:39.8	12:29:42.6	00:02.8	14	D	3884860.9	138745.5	
M1681	44	12:29:46.9	12:29:53.0	00:06.1	23	MC	3884861.4	138621.2	
M1682	44	12:29:57.4	12:30:23.7	00:26.3	13	MC	3884862.3	138425.3	
M1683	44	12:30:24.8	12:30:30.8	00:06.0	22	D	3884866.1	138267.6	
M1684	44	12:30:32.4	12:30:40.7	00:08.3	14	MC	3884868.6	138185.8	
M1685	44	12:30:44.5	12:30:47.3	00:02.8	17	D	3884872.5	138058.1	
M1686	44	12:30:50.6	12:30:53.9	00:03.3	23	-	3884874.4	137993.9	
M1687	44	12:31:04.2	12:31:17.9	00:13.7	24	MC	3884880.0	137808.9	
M1688	44	12:31:21.1	12:31:26.1	00:05.0	26	D	3884884.9	137646.0	
M1689	44	12:31:37.6	12:31:43.6	00:06.0	22	D	3884890.4	137465.6	
M1690	44	12:32:08.9	12:32:22.6	00:13.7	20	MC	3884900.6	137127.8	
M1691	44	12:32:34.7	12:32:38.5	00:03.8	19	MC	3884908.0	136883.3	
M1692	44	12:33:18.0	12:33:21.3	00:03.3	24	-	3884921.3	136441.5	
M1693	44	12:33:41.5	12:33:43.7	00:02.2	71	-	3884928.9	136191.7	
M1694	44	12:33:49.7	12:33:54.1	00:04.4	28	D	3884932.0	136087.2	
M1695	44	12:34:56.0	12:35:02.0	00:06.0	13	D	3884940.5	135387.5	
M1696	44	12:35:32.8	12:35:35.0	00:02.2	21	D	3884927.1	135018.2	
M1697	44	12:35:41.5	12:35:49.8	00:08.3	21	MC	3884930.4	134888.7	
M1698	44	12:36:02.4	12:36:07.3	00:04.9	14	D	3884935.7	134702.0	
M1699	44	12:36:18.8	12:36:45.1	00:26.3	27	MC	3884942.8	134452.7	
M1700	44	12:36:57.6	12:37:11.3	00:13.7	22	MC	3884953.7	134073.5	
M1701	44	12:37:35.9	12:37:40.9	00:05.0	28	D	3884964.1	133725.8	
M1702	44	12:38:02.3	12:38:05.6	00:03.3	15	D	3884971.4	133484.0	
M1703	44	12:38:16.5	12:38:20.3	00:03.8	14	D	3884976.3	133321.2	
M1704	44	12:38:28.0	12:38:42.8	00:14.8	30	MC	3884969.5	133118.4	
M1705	44	12:38:53.2	12:38:57.0	00:03.8	14	D	3884973.5	132936.4	
M1706	44	12:39:23.9	12:39:36.5	00:12.6	24	MC	3884982.4	132532.7	
M1707	45	12:42:23.0	12:42:26.3	00:03.3	22	D	3884865.9	132482.5	
M1708	45	12:44:54.7	12:44:55.8	00:01.1	80	+	3884844.7	133983.8	
M1709	45	12:45:05.6	12:45:08.3	00:02.7	31	-	3884843.2	134092.3	
M1710	45	12:49:35.3	12:49:36.9	00:01.6	36	+	3884803.6	136724.6	
M1711	45	12:49:40.8	12:49:43.5	00:02.7	45	-	3884802.5	136777.0	
M1712	45	12:50:20.9	12:50:23.2	00:02.3	32	-	3884794.7	137160.1	
M1713	45	12:50:52.7	12:50:54.4	00:01.7	38	+	3884788.5	137463.9	
M1714	45	12:51:08.5	12:51:10.2	00:01.7	53	-	3884785.4	137614.6	
M1715	45	12:51:12.9	12:51:14.0	00:01.1	40	-	3884784.5	137656.5	
M1716	45	12:51:48.5	12:51:51.8	00:03.3	37	D	3884777.2	138016.6	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M1717	45	12:52:09.3	12:52:11.0	00:01.7	44	+	3884773.5	138194.4	
M1718	45	12:52:11.5	12:52:13.1	00:01.6	34	+	3884773.1	138215.4	
M1719	45	12:53:06.2	12:53:07.3	00:01.1	37	-	3884761.5	138735.0	
M1720	45	12:54:09.8	12:54:13.1	00:03.3	84	+	3884745.9	139333.4	
M1721	45	12:55:22.1	12:55:25.4	00:03.3	26	-	3884728.2	140013.3	
M1722	45	12:57:41.3	12:57:42.4	00:01.1	97	+	3884700.5	141320.9	
M1723	45	12:57:46.8	12:57:47.9	00:01.1	42	-	3884699.7	141372.6	
M1724	45	12:58:03.9	12:58:06.6	00:02.7	26	D	3884696.9	141543.2	
M1725	45	12:58:57.6	12:58:59.3	00:01.7	32	+	3884688.7	142037.0	
M1726	45	12:59:59.0	13:00:01.2	00:02.2	49	+	3884679.3	142612.6	
M1727	45	13:00:38.9	13:00:40.0	00:01.1	40	+	3884673.1	142986.7	
M1728	45	13:04:37.8	13:04:40.0	00:02.2	51	+	3884652.0	145228.3	
M1729	45	13:05:38.1	13:05:39.2	00:01.1	59	+	3884648.1	145794.5	
M1730	45	13:06:08.3	13:06:09.4	00:01.1	32	-	3884646.2	146077.3	
M1731	45	13:06:12.7	13:06:13.8	00:01.1	32	+	3884645.9	146118.6	
M1732	45	13:07:23.5	13:07:25.1	00:01.6	71	+	3884645.9	146776.0	
M1733	45	13:08:35.3	13:08:38.0	00:02.7	50	+	3884643.9	147442.2	
M1734	45	13:11:12.1	13:11:24.2	00:12.1	25369	D	3884618.3	148885.0	
M1735	45	13:12:02.6	13:12:10.3	00:07.7	63	-	3884610.1	149349.7	
M1736	45	13:12:32.2	13:12:38.2	00:06.0	41	+	3884605.2	149622.4	
M1737	45	13:13:11.1	13:13:12.7	00:01.6	31	+	3884598.9	149979.8	
M1738	45	13:13:53.3	13:13:54.9	00:01.6	34	+	3884592.0	150368.1	
M1739	45	13:14:27.7	13:14:29.9	00:02.2	33	-	3884586.4	150685.4	
M1740	45	13:14:31.6	13:14:33.8	00:02.2	43	+	3884585.8	150720.8	
M1741	46	13:19:41.1	13:19:42.7	00:01.6	40	+	3884447.5	151539.8	
M1742	46	13:20:12.3	13:20:14.0	00:01.7	42	-	3884454.7	151182.4	
M1743	46	13:21:13.6	13:21:14.7	00:01.1	68	-	3884468.8	150480.8	
M1744	46	13:21:40.5	13:21:42.1	00:01.6	34	+	3884475.0	150173.1	
M1745	46	13:21:56.9	13:21:58.0	00:01.1	39	+	3884478.7	149985.5	
M1746	46	13:22:51.2	13:22:53.9	00:02.7	21	+	3884491.2	149365.0	
M1747	46	13:23:32.2	13:24:16.5	00:44.3	777	MC	3884500.7	148614.7	
M1748	46	13:27:56.7	13:27:59.4	00:02.7	22	+	3884540.9	145740.0	
M1749	46	13:29:18.7	13:29:21.0	00:02.3	68	D	3884557.4	144753.2	
M1750	46	13:29:38.5	13:29:41.3	00:02.8	41	-	3884561.2	144531.4	
M1751	46	13:30:04.8	13:30:05.9	00:01.1	22	-	3884566.4	144219.1	
M1752	46	13:30:16.9	13:30:21.9	00:05.0	28	-	3884568.8	144075.4	
M1753	46	13:31:05.1	13:31:08.3	00:03.2	22	+	3884578.4	143504.1	
M1754	46	13:31:33.0	13:31:34.6	00:01.6	41	+	3884583.9	143172.5	
M1755	46	13:35:24.4	13:35:26.1	00:01.7	31	+	3884636.1	140511.8	
M1756	46	13:36:02.7	13:36:03.8	00:01.1	31	+	3884642.9	140080.3	
M1757	46	13:36:13.7	13:36:15.3	00:01.6	54	+	3884644.8	139957.0	
M1758	46	13:36:50.0	13:36:52.2	00:02.2	50	-	3884651.2	139547.1	
M1759	46	13:37:03.7	13:37:08.6	00:04.9	46	-	3884653.7	139392.8	
M1760	46	13:37:28.3	13:37:29.4	00:01.1	96	+	3884658.0	139115.5	
M1761	46	13:38:27.5	13:38:29.7	00:02.2	37	-	3884666.6	138008.9	
M1762	46	13:39:06.6	13:39:07.7	00:01.1	41	+	3884672.0	138008.9	
M1763	46	13:40:07.5	13:40:08.6	00:01.1	81	+	3884684.6	137329.8	
M1764	46	13:40:51.3	13:40:52.4	00:01.1	30	-	3884694.2	136841.6	
M1765	46	13:40:53.5	13:40:55.1	00:01.6	65	+	3884694.8	136817.8	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M1766	46	13:41:09.9	13:41:13.2	00:03.3	45	-	3884699.4	136636.4	
M1767	46	13:41:46.1	13:41:48.3	00:02.2	37	+	3884709.3	136237.6	
M1768	46	13:41:57.6	13:41:59.2	00:01.6	71	-	3884712.5	136110.7	
M1769	46	13:42:05.2	13:42:06.3	00:01.1	35	+	3884714.6	136026.3	
M1770	46	13:42:06.3	13:42:07.4	00:01.1	45	+	3884714.9	136014.1	
M1771	46	13:42:48.5	13:42:50.2	00:01.7	38	+	3884724.5	135550.9	
M1772	46	13:42:55.0	13:42:56.1	00:01.1	70	+	3884725.7	135479.4	
M1773	46	13:43:16.4	13:43:17.5	00:01.1	38	+	3884729.5	135246.3	
M1774	46	13:44:25.8	13:44:27.5	00:01.7	35	+	3884740.9	134488.8	
M1775	46	13:45:13.5	13:45:15.1	00:01.6	35	-	3884747.4	133959.1	
M1776	46	13:46:21.0	13:46:22.1	00:01.1	23	+	3884756.9	133238.7	
M1777	47	13:50:11.6	13:50:12.7	00:01.1	57	+	3884671.4	132392.5	
M1778	47	13:50:22.6	13:50:24.2	00:01.6	40	+	3884670.1	132506.0	
M1779	47	13:51:48.6	13:51:50.3	00:01.7	44	+	3884659.5	133397.6	
M1780	47	13:51:53.0	13:51:54.1	00:01.1	84	+	3884658.9	133443.1	
M1781	47	13:52:33.0	13:52:34.7	00:01.7	29	-	3884654.0	133858.2	
M1782	47	13:52:45.1	13:52:49.0	00:03.9	26	-	3884652.5	133983.6	
M1783	47	13:53:13.7	13:53:15.9	00:02.2	23	-	3884648.9	134279.7	
M1784	47	13:53:31.7	13:53:34.5	00:02.8	26	-	3884645.7	134471.1	
M1785	47	13:53:42.7	13:53:43.8	00:01.1	48	-	3884643.7	134587.2	
M1786	47	13:54:59.3	13:55:01.0	00:01.7	43	-	3884629.7	135400.2	
M1787	47	13:55:15.8	13:55:18.5	00:02.7	48	-	3884626.7	135580.4	
M1788	47	13:59:17.0	13:59:18.6	00:01.6	20	-	3884581.3	138128.2	
M1789	47	13:59:49.8	13:59:50.9	00:01.1	32525	-	3884574.6	138475.4	
M1790	47	14:00:10.1	14:00:12.3	00:02.2	54	-	3884570.5	138689.0	
M1791	47	14:01:24.7	14:01:26.3	00:01.6	47	+	3884555.3	139475.9	
M1792	47	14:02:06.3	14:02:07.9	00:01.6	34	-	3884547.6	139910.0	
M1793	47	14:05:01.5	14:05:03.1	00:01.6	48	+	3884524.3	141679.7	
M1794	47	14:05:59.6	14:06:04.0	00:04.4	85	D	3884516.5	142258.6	
M1795	47	14:07:36.7	14:07:38.9	00:02.2	54	+	3884500.8	143215.0	
M1796	47	14:08:31.0	14:08:32.1	00:01.1	39	-	3884490.1	143741.6	
M1797	47	14:08:36.5	14:08:37.6	00:01.1	136	+	3884489.0	143794.8	
M1798	47	14:08:52.4	14:08:56.2	00:03.8	60	D	3884485.7	143948.4	
M1799	47	14:09:12.1	14:09:13.2	00:01.1	38	+	3884481.7	144139.1	
M1800	47	14:09:15.9	14:09:17.6	00:01.7	31	+	3884480.9	144175.8	
M1801	47	14:10:18.3	14:10:19.4	00:01.1	36	+	3884468.0	144779.1	
M1802	47	14:12:14.9	14:12:16.0	00:01.1	47	+	3884448.6	145888.6	
M1803	47	14:12:33.0	14:12:35.7	00:02.7	56	+	3884446.2	146058.7	
M1804	47	14:13:44.1	14:13:45.2	00:01.1	36	+	3884436.5	146728.2	
M1805	47	14:15:20.5	14:15:22.7	00:02.2	24	+	3884429.9	147610.0	
M1806	47	14:16:20.1	14:17:18.9	00:58.8	426	MC	3884425.9	148156.0	
M1807	47	14:19:50.1	14:19:51.1	00:01.0	28	+	3884401.8	150108.1	
M1808	48	14:30:28.0	14:30:29.1	00:01.1	58	+	3884279.2	150294.6	
M1809	48	14:30:39.5	14:30:42.8	00:03.3	36	-	3884279.6	150163.9	
M1810	48	14:31:35.9	14:31:37.0	00:01.1	56	+	3884288.0	149489.5	
M1811	48	14:32:01.6	14:32:06.6	00:05.0	58	MC	3884292.1	149180.5	
M1812	48	14:32:29.0	14:32:30.7	00:01.7	32	-	3884297.6	148846.0	
M1813	48	14:32:35.1	14:32:38.3	00:03.2	32	+	3884299.1	148770.8	
M1814	48	14:32:41.1	14:32:42.8	00:01.7	34	-	3884300.5	148696.1	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M1815	48	14:33:21.0	14:33:22.8	00:01.8	25	+	3884310.2	148198.9	
M1816	48	14:33:44.7	14:34:00.0	00:15.3	498	D	3884315.9	147904.9	
M1817	48	14:35:11.9	14:35:14.7	00:02.8	33	D	3884336.5	146816.4	
M1818	48	14:35:44.2	14:35:47.5	00:03.3	28	-	3884343.9	146410.0	
M1819	48	14:37:09.7	14:37:12.4	00:02.7	34	+	3884363.3	145334.1	
M1820	48	14:37:31.1	14:37:33.2	00:02.1	37	-	3884368.2	145042.3	
M1821	48	14:38:53.4	14:38:55.6	00:02.2	47	-	3884381.4	144058.0	
M1822	48	14:39:12.5	14:39:14.1	00:01.6	51	+	3884383.3	143829.8	
M1823	48	14:40:25.3	14:40:27.0	00:01.7	74	+	3884390.7	142961.0	
M1824	48	14:40:35.2	14:40:36.3	00:01.1	21	+	3884391.7	142843.5	
M1825	48	14:40:41.8	14:40:42.9	00:01.1	66	+	3884392.4	142764.8	
M1826	48	14:43:11.0	14:43:13.2	00:02.2	41	-	3884417.5	141007.8	
M1827	48	14:45:03.9	14:45:06.1	00:02.2	21	-	3884444.3	139695.5	
M1828	48	14:45:42.9	14:45:44.6	00:01.7	23	+	3884453.5	139242.4	
M1829	48	14:52:58.3	14:52:59.9	00:01.6	36	D	3884545.4	134405.5	
M1830	48	14:53:20.1	14:53:21.3	00:01.2	42	+	3884549.0	134162.0	
M1831	48	14:54:35.8	14:54:39.7	00:03.9	97	D	3884562.1	133289.5	
M1832	49	15:00:17.5	15:00:18.6	00:01.1	64	+	3884482.1	133276.6	
M1833	49	15:01:09.5	15:01:12.8	00:03.3	83	D	3884472.0	133814.2	
M1834	49	15:02:39.9	15:02:43.8	00:03.9	54	MC	3884453.9	134734.4	
M1835	49	15:02:56.9	15:02:58.6	00:01.7	21	+	3884450.6	134898.6	
M1836	49	15:03:07.3	15:03:08.4	00:01.1	21	+	3884448.4	135005.2	
M1837	49	15:03:26.4	15:03:27.5	00:01.1	30	+	3884444.5	135202.4	
M1838	49	15:03:29.2	15:03:31.4	00:02.2	86	D	3884443.9	135230.7	
M1839	49	15:04:06.0	15:04:07.6	00:01.6	61	+	3884436.3	135609.7	
M1840	49	15:04:21.3	15:04:22.9	00:01.6	43	+	3884433.1	135767.2	
M1841	49	15:04:26.7	15:04:28.9	00:02.2	28	-	3884432.0	135823.8	
M1842	49	15:05:08.9	15:05:13.3	00:04.4	23	-	3884423.2	136264.0	
M1843	49	15:06:02.1	15:06:04.3	00:02.2	22	-	3884412.3	136806.1	
M1844	49	15:06:15.8	15:06:16.9	00:01.1	71	+	3884409.5	136946.8	
M1845	49	15:06:57.4	15:07:00.1	00:02.7	52	+	3884401.1	137375.7	
M1846	49	15:08:35.0	15:08:37.2	00:02.2	67	+	3884385.3	138372.2	
M1847	49	15:09:16.6	15:09:18.9	00:02.3	22	+	3884380.7	138794.0	
M1848	49	15:09:40.8	15:09:42.5	00:01.7	77	+	3884378.0	139038.4	
M1849	49	15:10:29.0	15:10:30.1	00:01.1	82	-	3884372.7	139526.0	
M1850	49	15:11:34.4	15:11:37.7	00:03.3	30	+	3884365.4	140187.8	
M1851	49	15:14:37.4	15:14:38.5	00:01.1	29	+	3884335.4	141969.3	
M1852	49	15:14:53.3	15:14:56.1	00:02.8	20	+	3884332.6	142123.0	
M1853	49	15:15:46.4	15:15:47.5	00:01.1	44	-	3884323.5	142636.2	
M1854	49	15:16:12.1	15:16:14.9	00:02.8	61	D	3884318.8	142895.6	
M1855	49	15:17:08.6	15:17:09.7	00:01.1	56	+	3884309.2	143430.6	
M1856	49	15:17:33.2	15:17:34.3	00:01.1	27	-	3884305.7	143660.4	
M1857	49	15:17:49.1	15:17:50.2	00:01.1	33	+	3884303.5	143808.0	
M1858	49	15:18:01.7	15:18:02.8	00:01.1	76	-	3884301.8	143924.2	
M1859	49	15:18:08.8	15:18:09.9	00:01.1	34	+	3884300.8	143990.3	
M1860	49	15:19:06.9	15:19:09.1	00:02.2	58	+	3884295.6	144495.9	
M1861	49	15:19:27.2	15:19:28.9	00:01.7	73	+	3884294.6	144663.7	
M1862	49	15:23:46.8	15:23:48.4	00:01.6	28	+	3884272.4	146832.2	
M1863	49	15:24:35.5	15:24:38.3	00:02.8	24	D	3884266.9	147243.1	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M1864	49	15:25:05.6	15:25:06.7	00:01.1	47	+	3884263.5	147496.6	
M1865	49	15:25:13.4	15:25:52.8	00:39.4	424	MC	3884262.7	147561.8	
M1866	49	15:27:01.9	15:27:09.0	00:07.1	32	-	3884243.3	148494.1	
M1867	49	15:27:17.8	15:27:18.9	00:01.1	28	+	3884240.5	148631.2	A54
M1868	49	15:29:28.4	15:29:30.6	00:02.2	25	+	3884217.1	149753.8	
M1869	49	15:30:22.1	15:30:24.8	00:02.7	36	+	3884207.0	150246.1	
M1870	49	15:30:40.2	15:30:41.3	00:01.1	56	+	3884203.7	150411.2	
M1871	50	15:40:11.6	15:40:17.6	00:06.0	81	+	3884084.3	151058.5	
M1872	50	15:41:32.0	15:41:34.8	00:02.8	61	+	3884080.3	150228.8	
M1873	50	15:42:01.6	15:42:03.2	00:01.6	56	+	3884078.9	149924.1	
M1874	50	15:42:37.7	15:42:41.5	00:03.8	74	MC	3884078.4	149547.0	
M1875	50	15:42:53.1	15:42:55.3	00:02.2	25	-	3884080.8	149375.0	
M1876	50	15:44:59.1	15:45:01.3	00:02.2	21	+	3884100.6	147967.0	
M1877	50	15:45:47.3	15:46:11.4	00:24.1	295	D	3884110.2	147286.6	
M1878	50	15:46:38.9	15:46:40.0	00:01.1	47	+	3884116.3	146851.5	
M1879	50	15:46:43.3	15:46:44.3	00:01.0	34	+	3884117.0	146802.4	
M1880	50	15:50:06.7	15:50:07.8	00:01.1	21	+	3884154.7	144516.6	
M1881	50	15:52:41.7	15:52:43.9	00:02.2	52	D	3884190.2	142808.5	
M1882	50	15:53:00.9	15:53:02.6	00:01.7	39	-	3884195.2	142608.8	
M1883	50	15:53:06.4	15:53:09.7	00:03.3	38	D	3884197.1	142534.5	
M1884	50	15:56:40.4	15:56:41.5	00:01.1	21	-	3884250.6	140335.2	
M1885	50	15:57:14.4	15:57:16.0	00:01.6	38	+	3884255.1	140002.1	
M1886	50	15:57:24.2	15:57:25.9	00:01.7	29	+	3884256.4	139905.6	
M1887	50	16:00:08.1	16:00:09.2	00:01.1	41	+	3884279.9	138299.8	
M1888	50	16:13:39.2	16:13:40.9	00:01.7	22	+	3884355.2	133715.6	
M1889	50	16:12:08.9	16:12:11.7	00:02.8	30	+	3884346.0	134629.1	
M1890	50	16:10:46.2	16:10:48.4	00:02.2	24	+	3884325.4	135432.6	
M1891	51	16:31:55.5	16:31:57.2	00:01.7	27	-	3884192.2	140842.8	
M1892	51	16:30:34.9	16:30:38.2	00:03.3	42	+	3884170.1	140166.8	
M1893	51	16:30:15.8	16:30:16.9	00:01.1	86	+	3884167.9	139996.0	
M1894	51	16:29:44.6	16:29:49.0	00:04.4	22	+	3884164.7	139715.3	
M1895	51	16:28:01.6	16:28:03.3	00:01.7	22	+	3884177.4	138702.4	
M1896	51	16:26:28.0	16:26:33.5	00:05.5	20	+	3884191.9	137780.6	
M1897	51	16:26:09.9	16:26:14.3	00:04.4	22	D	3884194.0	137627.5	
M1898	51	16:24:37.3	16:24:41.2	00:03.9	20	-	3884208.2	136704.9	
M1899	51	16:23:25.4	16:23:28.2	00:02.8	22	+	3884221.9	135980.6	
M1900	51	16:23:21.1	16:23:23.8	00:02.7	23	+	3884222.8	135936.7	
M1901	51	16:23:11.2	16:23:14.0	00:02.8	23	+	3884224.7	135837.5	
M1902	51	16:22:09.3	16:22:11.5	00:02.2	20	+	3884233.6	135208.4	
M1903	51	16:21:23.1	16:21:25.3	00:02.2	23	-	3884240.0	134711.0	
M1904	51	16:18:12.6	16:18:14.2	00:01.6	25	-	3884252.6	132830.4	
M1905	51	16:18:07.7	16:18:10.9	00:03.2	26	D	3884252.5	132775.6	
M1906	51	16:17:52.4	16:17:54.0	00:01.6	20	+	3884252.1	132611.9	
M1907	51	17:30:58.4	17:31:00.1	00:01.7	26	+	3883978.4	151405.3	
M1908	51	17:30:26.7	17:30:32.2	00:05.5	32	D	3883989.4	151123.3	
M1909	51	17:28:01.5	17:28:03.1	00:01.6	42	+	3883993.3	149666.1	
M1910	51	17:27:29.8	17:27:33.1	00:03.3	28	-	3883995.7	149365.5	
M1911	51	17:27:26.0	17:27:27.1	00:01.1	21	-	3883995.9	149328.8	
M1912	51	17:26:13.6	17:26:18.0	00:04.4	22	D	3884000.3	148655.7	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M1913	51	17:25:38.6	17:25:40.3	00:01.7	21	+	3884009.3	148309.1	
M1914	51	17:25:20.0	17:25:22.2	00:02.2	23	+	3884014.7	148133.5	
M1915	51	17:24:04.4	17:24:05.4	00:01.0	28	-	3884040.7	147421.9	
M1916	51	17:23:58.3	17:23:59.4	00:01.1	28	+	3884041.8	147366.2	
M1917	51	17:23:15.0	17:23:42.3	00:27.3	554	MC	3884046.6	147117.5	
M1918	51	17:22:55.8	17:23:05.7	00:09.9	99	+	3884047.7	146794.5	
M1919	51	17:22:17.5	17:22:19.7	00:02.2	30	-	3884048.0	146447.7	
M1920	51	17:21:14.9	17:21:16.0	00:01.1	21	+	3884058.0	145872.4	
M1921	51	17:20:45.8	17:20:50.2	00:04.4	30	D	3884062.7	145623.5	
M1922	51	17:19:18.2	17:19:19.8	00:01.6	61	+	3884073.3	144809.7	
M1923	51	17:18:52.5	17:18:54.2	00:01.7	30	+	3884074.2	144745.1	
M1924	51	17:18:21.2	17:18:27.3	00:06.1	28	MC	3884097.7	144342.5	
M1925	51	17:18:01.0	17:18:03.2	00:02.2	29	+	3884115.3	144151.7	
M1926	52	17:58:43.1	17:58:44.2	00:01.1	34	-	3884158.8	133255.1	
M1927	52	17:58:36.0	17:58:40.9	00:04.9	27	D	3884159.6	133320.3	
M1928	52	17:56:00.4	17:56:03.1	00:02.7	105	D	3884133.5	135188.9	
M1929	52	17:55:47.3	17:55:51.1	00:03.8	31	D	3884131.2	135339.8	
M1930	52	17:55:28.1	17:55:31.4	00:03.3	25	D	3884127.8	135563.9	
M1931	52	17:54:56.8	17:55:03.9	00:07.1	27	MC	3884120.3	135912.0	
M1932	52	17:54:19.6	17:54:22.4	00:02.8	23	-	3884106.1	136406.5	
M1933	52	17:54:05.3	17:54:06.9	00:01.6	23	+	3884101.2	136576.7	
M1934	52	17:53:41.2	17:53:53.3	00:12.1	35	MC	3884095.3	136785.4	
M1935	52	17:53:25.3	17:53:31.4	00:06.1	30	MC	3884088.3	137026.2	
M1936	52	17:53:10.5	17:53:17.1	00:06.6	59	MC	3884086.6	137208.5	
M1937	52	17:51:48.8	17:51:50.9	00:02.1	25	-	3884076.6	138242.0	
M1938	52	17:50:06.4	17:50:09.1	00:02.7	26	-	3884062.0	139489.3	
M1939	52	17:49:23.2	17:49:27.6	00:04.4	26	D	3884044.4	140002.0	
M1940	52	17:48:07.8	17:48:09.4	00:01.6	39	+	3884026.2	140921.0	
M1941	52	17:47:56.8	17:47:59.0	00:02.2	29	+	3884024.4	141050.8	
M1942	52	17:47:50.7	17:47:51.8	00:01.1	25	+	3884023.4	141122.0	
M1943	52	17:46:21.4	17:46:25.2	00:03.8	28	D	3884012.9	142198.3	
M1944	52	17:45:30.0	17:45:37.1	00:07.1	64	-	3884005.7	142847.9	
M1945	52	17:44:32.4	17:44:33.5	00:01.1	65	+	3883995.8	143579.8	
M1946	52	17:44:19.3	17:44:21.5	00:02.2	32	-	3883992.5	143756.3	
M1947	52	17:43:02.2	17:43:03.8	00:01.6	21	-	3883973.3	144791.8	
M1948	52	17:42:27.1	17:42:28.2	00:01.1	21	+	3883964.6	145262.3	
M1949	52	17:42:23.8	17:42:24.9	00:01.1	29	+	3883963.8	145306.6	
M1950	52	17:42:00.3	17:42:02.5	00:02.2	23	-	3883958.6	145623.1	
M1951	52	17:41:50.4	17:41:51.5	00:01.1	32	+	3883956.8	145756.6	
M1952	52	17:41:33.5	17:41:34.5	00:01.0	51	+	3883953.7	145984.9	
M1953	52	17:41:08.8	17:41:14.8	00:06.0	211	-	3883949.3	146317.7	
M1954	52	17:40:50.6	17:40:60.0	00:09.4	70	-	3883946.0	146562.1	
M1955	52	17:40:39.1	17:40:47.9	00:08.8	54	-	3883943.9	146717.0	
M1956	52	17:39:11.5	17:39:13.2	00:01.7	52	+	3883913.5	147884.6	
M1957	52	17:38:33.1	17:38:34.2	00:01.1	30	+	3883903.8	148384.6	
M1958	52	17:38:15.6	17:38:17.2	00:01.6	25	+	3883899.3	148612.1	
M1959	52	17:38:03.0	17:38:04.6	00:01.6	31	D	3883896.3	148768.8	
M1960	52	17:37:22.4	17:37:23.4	00:01.0	86	+	3883885.8	149303.9	
M1961	52	17:37:05.4	17:37:08.1	00:02.7	47	+	3883881.5	149524.9	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M1962	52	17:36:47.3	17:36:48.4	00:01.1	52	+	3883877.0	149759.7	
M1963	52	17:36:27.6	17:36:29.8	00:02.2	56	D	3883872.8	149995.4	
M1964	52	17:36:10.0	17:36:12.8	00:02.8	49	-	3883868.6	150231.3	
M1965	52	17:35:21.3	17:35:22.4	00:01.1	45	-	3883855.6	150811.0	
M1966	52	17:35:10.3	17:35:11.4	00:01.1	91	+	3883852.7	150939.3	
M1967	52	17:34:50.1	17:34:51.2	00:01.1	155	+	3883847.5	151176.3	
M1968	52	17:34:26.6	17:34:27.6	00:01.0	40	+	3883841.3	151452.6	
M1969	53	18:03:55.2	18:03:58.0	00:02.8	31	D	3884091.4	133939.7	
M1970	53	18:03:35.5	18:03:41.6	00:06.1	32	D	3884082.9	133739.0	
M1971	53	18:03:28.4	18:03:34.4	00:06.0	33	-	3884078.6	133638.9	
M1972	53	18:03:04.2	18:03:06.4	00:02.2	31	+	3884067.5	133378.2	
M1973	53	18:02:23.2	18:02:24.3	00:01.1	30	+	3884062.4	132928.5	
M1974	53a	18:06:47.9	18:06:49.0	00:01.1	88	-	3883897.0	135837.2	
M1975	53a	18:06:10.2	18:06:11.8	00:01.6	50	+	3883887.2	135360.6	
M1976	53a	18:05:20.8	18:05:27.4	00:06.6	118	MC	3883899.7	134854.5	
M1977	53a	18:05:16.5	18:05:18.7	00:02.2	45	D	3883904.3	134775.8	
M1978	53a	18:05:14.3	18:05:15.4	00:01.1	39	+	3883904.4	134730.5	
M1979	53a	18:05:11.5	18:05:13.7	00:02.2	48	-	3883905.9	134698.7	
M1980	54	12:47:57.7	12:47:59.9	00:02.2	54	D	3884001.9	132223.6	
M1981	54	12:48:00.5	12:48:10.9	00:10.4	87	MC	3884000.0	132262.9	
M1982	54	12:48:19.1	12:48:22.9	00:03.8	61	+	3883993.9	132391.5	
M1983	54	12:48:28.4	12:48:30.6	00:02.2	98	-	3883990.4	132464.9	
M1984	54	12:48:33.3	12:48:37.2	00:03.9	87	MC	3883987.9	132516.3	
M1985	54	12:48:56.9	12:49:01.3	00:04.4	104	D	3883979.1	132701.0	
M1986	54	12:49:06.1	12:49:09.4	00:03.3	84	D	3883975.8	132769.6	
M1987	54	12:49:13.8	12:49:15.4	00:01.6	43	+	3883973.3	132821.4	
M1988	54	12:49:19.3	12:49:20.4	00:01.1	76	+	3883971.2	132864.2	
M1989	54	12:49:28.0	12:49:31.9	00:03.9	96	D	3883967.9	132932.8	
M1990	54	12:49:57.1	12:49:58.7	00:01.6	68	+	3883957.0	133160.7	
M1991	54	12:50:40.9	12:50:45.9	00:05.0	93	D	3883944.9	133493.6	
M1992	54	12:51:15.0	12:51:16.7	00:01.7	45	-	3883939.6	133741.8	
M1993	54	12:51:18.9	12:51:20.5	00:01.6	68	-	3883939.0	133769.8	
M1994	54	12:51:28.1	12:51:29.3	00:01.2	46	+	3883937.6	133837.5	
M1995	54	12:52:11.9	12:52:14.7	00:02.8	102	+	3883930.8	134156.3	
M1996	54	12:52:21.2	12:52:23.4	00:02.2	117	D	3883929.3	134224.0	
M1997	54	12:52:24.5	12:52:25.6	00:01.1	59	-	3883928.8	134247.9	
M1998	54	12:54:00.5	12:54:01.6	00:01.1	38	-	3883913.9	134946.8	
M1999	54	12:54:04.9	12:54:06.6	00:01.7	80	+	3883913.2	134978.8	
M2000	54	12:54:06.6	12:54:07.6	00:01.0	40	+	3883912.9	134990.8	
M2001	54	12:54:15.9	12:54:17.0	00:01.1	47	+	3883911.6	135054.9	
M2002	54	12:54:18.6	12:54:19.8	00:01.2	99	+	3883911.1	135078.8	
M2003	54	12:54:30.1	12:54:31.3	00:01.2	80	+	3883909.4	135158.6	
M2004	54	12:55:18.4	12:55:20.0	00:01.6	42	+	3883901.8	135514.1	
M2005	54	12:55:34.8	12:55:37.0	00:02.2	55	D	3883899.2	135633.5	
M2006	54	12:56:08.9	12:56:10.0	00:01.1	59	+	3883893.9	135881.3	
M2007	54	12:56:10.5	12:56:12.2	00:01.7	37	+	3883893.7	135893.3	
M2008	54	12:56:12.7	12:56:14.4	00:01.7	74	+	3883893.3	135909.3	
M2010	54	12:58:29.4	12:58:31.1	00:01.7	67	+	3883891.5	136859.1	
M2011	54	12:59:05.5	12:59:07.7	00:02.2	41	-	3883891.0	137109.8	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M2012	54	12:59:18.1	12:59:25.2	00:07.1	63	MC	3883890.8	137208.4	
M2013	54	12:59:44.3	12:59:45.4	00:01.1	55	+	3883890.4	137379.0	
M2014	54	13:00:10.6	13:00:11.7	00:01.1	184	+	3883888.7	137562.3	
M2015	54	13:00:12.8	13:00:15.6	00:02.8	55	D	3883888.1	137589.4	
M2016	54	13:00:33.6	13:00:34.8	00:01.2	74	+	3883885.0	137724.7	
M2017	54	13:00:45.7	13:00:46.8	00:01.1	88	+	3883883.1	137809.6	
M2018	54	13:01:10.9	13:01:14.7	00:03.8	40	-	3883879.0	137987.4	
M2019	54	13:02:32.2	13:02:34.9	00:02.7	35	+	3883865.8	138559.6	
M2020	54	13:02:45.9	13:02:48.6	00:02.7	64	D	3883863.3	138667.8	
M2021	54	13:03:40.1	13:03:44.5	00:04.4	47	-	3883855.4	139037.7	
M2022	54	13:04:57.4	13:04:59.6	00:02.2	32	-	3883848.1	139572.6	
M2023	54	13:05:30.8	13:05:32.5	00:01.7	56	+	3883845.0	139804.3	
M2024	54	13:05:47.3	13:05:48.4	00:01.1	62	+	3883843.5	139918.7	
M2025	54	13:06:31.3	13:06:40.1	00:08.8	66	MC	3883839.3	140223.0	
M2026	54	13:07:29.9	13:07:32.1	00:02.2	42	-	3883833.9	140629.3	
M2027	54	13:07:41.4	13:07:43.6	00:02.2	51	+	3883832.8	140708.9	
M2028	54	13:08:07.7	13:08:08.8	00:01.1	82	+	3883830.3	140891.0	
M2029	54	13:08:58.1	13:08:59.8	00:01.7	77	-	3883825.6	141240.3	
M2030	54	13:09:24.3	13:09:25.4	00:01.1	47	-	3883823.2	141421.8	
M2031	54	13:10:49.7	13:10:53.6	00:03.9	29	-	3883815.6	142021.1	
M2032	54	13:11:19.3	13:11:20.4	00:01.1	40	+	3883813.4	142236.1	
M2033	54	13:12:59.2	13:13:01.3	00:02.1	83	+	3883806.1	142961.5	
M2034	54	13:13:16.1	13:13:18.9	00:02.8	57	-	3883804.8	143084.6	
M2035	54	13:14:02.2	13:14:04.4	00:02.2	84	+	3883801.5	143419.4	
M2036	54	13:16:41.6	13:16:42.8	00:01.2	84	+	3883789.7	144577.6	
M2037	54	13:17:34.3	13:17:36.6	00:02.3	88	+	3883784.2	144954.7	
M2038	54	13:18:05.1	13:18:06.2	00:01.1	137	+	3883780.3	145173.0	
M2039	54	13:18:13.3	13:18:14.4	00:01.1	58	+	3883779.3	146152.1	
M2040	54	13:18:30.3	13:18:31.4	00:01.1	85	+	3883777.2	145351.7	
M2041	54	13:19:20.6	13:19:43.8	00:23.2	124	-	3883770.9	145708.6	
M2042	54	13:19:59.6	13:20:04.6	00:05.0	71	D	3883766.1	145985.2	
M2043	54	13:20:59.3	13:21:00.4	00:01.1	88	+	3883758.6	146408.5	
M2044	54	13:21:17.4	13:21:19.6	00:02.2	69	D	3883755.6	146533.9	
M2045	54	13:21:53.8	13:21:57.0	00:03.2	58	+	3883747.7	146788.8	
M2046	54	13:22:33.8	13:22:39.3	00:05.5	81	MC	3883741.2	147071.8	
M2047	54	13:22:51.4	13:22:52.4	00:01.0	41	-	3883738.9	147183.5	
M2048	54	13:23:19.3	13:23:20.9	00:01.6	79	-	3883734.9	147379.7	
M2049	54	13:24:41.4	13:24:44.2	00:02.8	61	-	3883723.2	147957.5	
M2050	54	13:24:54.6	13:25:01.7	00:07.1	77	+	3883721.3	148049.9	
M2051	54	13:25:56.4	13:25:58.0	00:01.6	81	+	3883716.8	148499.4	
M2052	54	13:26:00.8	13:26:02.4	00:01.6	74	+	3883716.7	148532.0	
M2053	54	13:26:05.7	13:26:07.3	00:01.6	49	+	3883716.6	148568.7	
M2054	54	13:26:11.2	13:26:12.3	00:01.1	45	-	3883716.4	148609.2	
M2055	54	13:26:18.3	13:26:19.9	00:01.6	63	+	3883716.2	148662.1	
M2056	54	13:26:56.1	13:26:57.2	00:01.1	55	+	3883715.1	148938.4	
M2057	54	13:27:31.1	13:27:32.8	00:01.7	50	+	3883714.1	149202.3	
M2058	54	13:28:34.8	13:28:35.8	00:01.0	43	+	3883712.2	149674.2	
M2059	54	13:28:53.4	13:28:56.1	00:02.7	46	D	3883711.7	149812.2	
M2060	54	13:29:32.4	13:29:34.5	00:02.1	68	D	3883710.6	150101.4	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M2061	54	13:29:36.2	13:29:40.6	00:04.4	61	D	3883710.4	150129.6	
M2062	54	13:29:42.2	13:29:43.9	00:01.7	38	+	3883710.3	150174.4	
M2063	54	13:30:15.6	13:30:18.4	00:02.8	57	D	3883709.2	150434.7	
M2064	54	13:30:48.5	13:30:51.3	00:02.8	74	D	3883708.3	150674.6	
M2065	54	13:31:12.2	13:31:14.4	00:02.2	81	+	3883707.6	150842.3	
M2066	54	13:31:29.2	13:31:30.3	00:01.1	64	+	3883707.2	150967.9	
M2067	54	13:31:58.3	13:32:00.5	00:02.2	79	+	3883706.3	151183.7	
M2068	54	13:32:11.5	13:32:14.2	00:02.7	121	D	3883705.9	151289.4	
M2069	54	13:32:20.2	13:32:21.9	00:01.7	50	+	3883705.7	151346.5	
M2070	55	13:53:16.0	13:53:17.7	00:01.7	52	-	3883548.8	151011.7	
M2071	55	13:53:22.1	13:53:23.2	00:01.1	56	+	3883549.8	150952.1	
M2072	55	13:53:33.6	13:53:38.0	00:04.4	72	D	3883552.0	150818.6	
M2073	55	13:54:10.4	13:54:27.9	00:17.5	128	MC	3883558.8	150399.9	
M2074	55	13:54:29.0	13:55:03.5	00:34.5	84	-	3883560.5	150298.2	
M2075	55	13:55:57.7	13:55:58.8	00:01.1	46	+	3883574.8	149430.8	
M2076	55	13:56:16.9	13:56:18.0	00:01.1	52	+	3883577.8	149243.6	
M2077	55	13:58:50.9	13:58:52.0	00:01.1	51	-	3883614.0	147631.5	
M2078	55	13:59:51.2	13:59:53.4	00:02.2	78	+	3883631.0	146973.4	
M2079	55	14:00:01.1	14:00:02.2	00:01.1	99	+	3883633.0	146862.9	
M2080	55	14:01:50.2	14:02:08.8	00:18.6	495	D	3883644.1	145531.6	
M2081	55	14:04:59.4	14:05:01.0	00:01.6	107	+	3883695.4	143664.2	
M2082	55	14:05:41.0	14:05:44.8	00:03.8	66	D	3883702.5	143215.7	
M2083	55	14:07:14.1	14:07:15.2	00:01.1	48	+	3883718.2	142225.1	
M2084	55	14:08:22.6	14:08:29.2	00:06.6	34	D	3883731.1	141417.1	
M2085	55	14:08:47.3	14:08:50.0	00:02.7	46	D	3883734.8	141182.3	
M2086	55	14:16:48.6	14:16:50.8	00:02.2	32	-	3883815.7	135879.6	
M2087	55	14:18:08.0	14:18:11.3	00:03.3	44	D	3883834.4	135014.9	
M2088	55	14:19:09.0	14:19:10.1	00:01.1	55	+	3883848.8	134350.5	
M2089	55	14:19:17.7	14:19:18.8	00:01.1	70	+	3883850.9	134255.1	
M2090	55	14:20:15.7	14:20:17.4	00:01.7	50	-	3883861.4	133622.1	
M2091	55	14:20:32.2	14:20:33.8	00:01.6	79	+	3883866.9	133444.4	
M2092	55	14:20:55.8	14:20:57.4	00:01.6	58	+	3883874.9	133188.6	
M2093	55	14:22:01.6	14:22:03.8	00:02.2	61	+	3883897.0	132477.1	
M2094	56	14:26:53.1	14:26:54.1	00:01.0	83	+	3883754.3	132998.4	
M2095	56	14:27:32.5	14:27:33.6	00:01.1	80	+	3883751.7	133278.0	
M2096	56	14:27:44.0	14:27:46.2	00:02.2	120	-	3883750.9	133364.5	
M2097	56	14:27:52.2	14:27:55.0	00:02.8	87	-	3883750.3	133423.4	
M2098	56	14:28:36.2	14:28:37.8	00:01.6	68	+	3883747.3	133743.0	
M2099	56	14:29:16.2	14:29:17.3	00:01.1	97	+	3883744.7	134026.3	
M2100	56	14:32:17.3	14:32:18.4	00:01.1	84	+	3883732.5	135326.4	
M2101	56	14:36:04.1	14:36:08.0	00:03.9	67	D	3883715.8	136849.2	
M2102	56	14:36:50.1	14:36:51.2	00:01.1	191	+	3883712.6	137140.3	
M2103	56	14:40:21.4	14:40:22.5	00:01.1	40	+	3883688.1	138576.6	
M2104	56	14:41:20.7	14:41:23.4	00:02.7	70	+	3883677.9	138987.2	
M2105	56	14:44:46.3	14:44:47.4	00:01.1	99	+	3883643.4	140454.8	
M2106	56	14:46:49.6	14:46:51.2	00:01.6	153	+	3883631.8	141513.8	
M2107	56	14:47:12.6	14:47:13.7	00:01.1	41	+	3883629.7	141711.7	
M2108	56	14:47:18.1	14:47:19.8	00:01.7	56	+	3883629.2	141758.9	
M2109	56	14:47:37.9	14:47:40.1	00:02.2	45	+	3883627.3	141928.5	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M2110	56	14:47:41.7	14:47:42.9	00:01.2	64	+	3883627.0	141961.5	
M2111	56	14:47:54.9	14:47:57.1	00:02.2	80	-	3883625.7	142074.9	
M2112	56	14:48:46.8	14:48:47.9	00:01.1	48	-	3883620.9	142520.8	A60
M2113	56	14:48:56.7	14:48:57.8	00:01.1	56	-	3883619.9	142605.9	
M2114	56	14:49:03.9	14:49:05.0	00:01.1	67	+	3883619.3	142667.2	
M2115	56	14:49:46.7	14:49:47.8	00:01.1	119	+	3883613.0	143036.6	
M2116	56	14:49:53.8	14:50:02.6	00:08.8	133	MC	3883612.0	143098.0	
M2117	56	14:51:07.7	14:51:09.4	00:01.7	86	+	3883600.9	143736.7	
M2118	56	14:51:19.7	14:51:21.4	00:01.7	75	+	3883599.1	143840.2	
M2119	56	14:53:03.3	14:53:08.2	00:04.9	133	MC	3883577.5	144758.2	
M2120	56	14:54:03.0	14:54:11.2	00:08.2	226	-	3883565.1	145258.2	
M2121	56	14:54:16.7	14:54:18.9	00:02.2	137	D	3883562.2	145377.2	
M2122	56	14:54:26.0	14:54:27.6	00:01.6	93	+	3883560.2	145458.0	A61
M2123	56	14:54:53.4	14:54:54.4	00:01.0	114	+	3883554.3	145696.0	
M2124	56	14:55:09.3	14:55:12.0	00:02.7	80	-	3883550.9	145834.5	
M2125	56	14:55:25.7	14:55:27.3	00:01.6	81	-	3883547.4	145977.0	
M2126	56	14:55:32.3	14:55:42.1	00:09.8	143	MC	3883544.9	146076.9	
M2127	56	14:56:03.0	14:56:04.6	00:01.6	143	+	3883539.4	146301.1	
M2128	56	14:56:29.8	14:56:31.5	00:01.7	102	+	3883533.6	146534.4	
M2129	56	14:57:12.6	14:57:24.7	00:12.1	143	MC	3883524.4	146906.2	
M2130	56	14:57:42.1	14:57:43.3	00:01.2	61	+	3883518.1	147163.0	
M2131	56	14:57:44.4	14:57:45.4	00:01.0	76	-	3883517.6	147182.0	
M2132	56	14:57:47.6	14:57:49.3	00:01.7	49	+	3883516.9	147210.7	
M2133	56	14:58:17.1	14:58:20.4	00:03.3	108	D	3883512.5	147466.8	
M2134	56	14:58:32.4	14:58:33.5	00:01.1	79	+	3883511.1	147600.5	
M2135	56	14:58:38.4	14:58:39.5	00:01.1	103	+	3883510.5	147652.8	
M2136	56	14:58:42.8	14:58:43.9	00:01.1	108	+	3883510.1	147691.1	
M2137	56	14:58:53.2	14:58:54.9	00:01.7	73	+	3883509.1	147781.6	
M2138	56	14:59:39.2	14:59:40.3	00:01.1	73	-	3883504.7	148182.7	
M2139	56	14:59:50.2	14:59:52.9	00:02.7	107	D	3883503.5	148292.4	
M2140	56	15:00:02.8	15:00:04.5	00:01.7	93	+	3883502.4	148388.2	
M2141	56	15:00:12.2	15:00:13.8	00:01.6	64	-	3883501.6	148469.7	
M2142	56	15:00:21.5	15:00:23.1	00:01.6	61	-	3883500.7	148550.7	
M2143	56	15:00:28.1	15:00:29.2	00:01.1	92	+	3883500.0	148608.2	
M2144	56	15:00:35.7	15:00:36.8	00:01.1	67	+	3883499.3	148674.8	
M2145	56	15:01:45.9	15:01:50.3	00:04.4	90	MC	3883492.3	149315.1	
M2146	56	15:02:22.8	15:02:23.8	00:01.0	81	+	3883489.1	149607.3	
M2147	56	15:02:35.9	15:02:40.3	00:04.4	124	MC	3883487.6	149745.8	
M2148	56	15:02:57.9	15:04:27.7	01:29.8	250	-	3883485.8	149913.1	
M2149	57	15:27:30.3	15:27:43.4	00:13.1	204	-	3883368.8	151115.2	
M2150	57	15:27:56.6	15:27:57.7	00:01.1	81	+	3883371.9	150824.5	
M2151	57	15:28:41.0	15:29:14.4	00:33.4	3427	D	3883379.0	150163.9	
M2152	57	15:29:36.9	15:29:38.5	00:01.6	90	+	3883383.9	149715.6	
M2153	57	15:30:35.4	15:30:37.1	00:01.7	56	D	3883390.8	149067.8	
M2154	57	15:30:53.0	15:30:55.2	00:02.2	91	D	3883392.9	148873.7	
M2155	57	15:31:04.0	15:31:05.1	00:01.1	57	+	3883394.2	148752.0	
M2156	57	15:31:09.5	15:31:12.8	00:03.3	93	MC	3883395.5	148675.8	
M2157	57	15:31:27.5	15:31:28.6	00:01.1	73	+	3883399.5	148473.7	
M2158	57	15:32:17.9	15:32:21.8	00:03.9	93	D	3883411.6	147872.4	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M2159	57	15:32:29.4	15:32:30.5	00:01.1	56	+	3883414.3	147735.4	
M2160	57	15:32:39.8	15:32:40.9	00:01.1	42	-	3883416.8	147611.4	
M2161	57	15:32:52.4	15:32:54.6	00:02.2	52	D	3883419.8	147461.2	
M2162	57	15:34:09.1	15:34:10.2	00:01.1	42	+	3883438.2	146547.0	
M2163	57	15:34:35.0	15:34:37.2	00:02.2	78	D	3883444.3	146238.8	
M2164	57	15:36:11.5	15:36:44.5	00:33.0	438	D	3883472.8	144840.2	
M2165	57	15:37:43.1	15:37:44.2	00:01.1	52	+	3883489.9	144013.5	
M2166	57	15:41:25.6	15:41:28.4	00:02.8	61	D	3883533.3	141379.7	
M2167	57	15:42:04.6	15:42:05.7	00:01.1	38	-	3883536.3	140915.3	
M2168	57	15:42:39.7	15:42:40.8	00:01.1	51	+	3883539.0	140496.7	
M2169	57	15:44:34.8	15:44:38.1	00:03.3	27	-	3883557.5	139120.6	
M2170	57	15:46:59.4	15:47:00.6	00:01.2	96	+	3883599.8	137391.1	
M2171	57	15:47:58.2	15:48:01.5	00:03.3	61	+	3883613.6	136702.3	
M2172	57	15:48:38.3	15:48:45.9	00:07.6	95	MC	3883624.1	136181.6	
M2173	57	15:49:46.8	15:49:53.4	00:06.6	71	MC	3883639.5	135410.9	
M2174	57	15:50:15.3	15:50:18.5	00:03.2	41	-	3883645.8	135096.5	
M2175	57	15:51:03.6	15:51:05.3	00:01.7	44	+	3883659.1	134531.3	
M2176	57	15:51:06.9	15:51:08.6	00:01.7	34	+	3883660.0	134492.8	
M2177	57	15:51:13.5	15:51:14.5	00:01.0	42	+	3883661.8	134416.3	
M2178	57	15:51:22.2	15:51:26.6	00:04.4	128	D	3883664.7	134294.9	
M2179	57	15:53:02.5	15:53:04.1	00:01.6	78	+	3883692.2	133142.4	
M2180	57	15:53:42.5	15:53:44.7	00:02.2	55	+	3883703.3	132675.1	
M2181	57	15:53:54.5	15:53:56.2	00:01.7	132	D	3883706.6	132534.3	
M2182	57	15:54:06.7	15:54:14.4	00:07.7	116	MC	3883711.3	132340.9	
M2183	58	15:57:30.3	15:57:31.4	00:01.1	63	+	3883566.4	132430.3	
M2184	58	15:57:31.9	15:57:33.0	00:01.1	109	+	3883566.3	132441.8	
M2185	58	15:57:56.6	15:58:00.4	00:03.8	46	-	3883563.7	132614.3	
M2186	58	15:59:21.6	15:59:22.7	00:01.1	52	-	3883555.0	133209.6	
M2187	58	16:02:05.8	16:02:09.7	00:03.9	82	D	3883538.1	134359.4	
M2188	58	16:02:21.8	16:02:23.4	00:01.6	67	+	3883536.5	134471.0	
M2189	58	16:02:25.6	16:02:30.1	00:04.5	64	D	3883535.9	134513.4	
M2190	58	16:03:49.1	16:03:50.2	00:01.1	47	+	3883527.6	135082.5	
M2191	58	16:06:10.9	16:06:17.5	00:06.6	53	MC	3883511.1	136207.2	
M2192	58	16:07:05.8	16:07:07.4	00:01.6	61	-	3883504.8	136637.5	
M2193	58	16:09:22.8	16:09:24.5	00:01.7	83	+	3883488.4	137756.3	
M2194	58	16:09:30.0	16:09:32.2	00:02.2	68	-	3883487.5	137814.7	
M2195	58	16:10:09.9	16:10:11.0	00:01.1	46	-	3883482.6	138138.7	
M2196	58	16:10:40.0	16:10:41.1	00:01.1	57	+	3883478.3	138374.1	
M2197	58	16:11:39.2	16:11:40.9	00:01.7	53	+	3883469.9	138836.9	A65
M2198	58	16:12:08.2	16:12:09.9	00:01.7	43	-	3883465.8	139063.7	
M2199	58	16:12:48.3	16:12:51.1	00:02.8	77	D	3883460.2	139377.7	
M2200	58	16:13:04.2	16:13:05.8	00:01.6	45	+	3883457.9	139505.6	
M2201	58	16:13:12.9	16:13:15.1	00:02.2	79	D	3883456.7	139570.0	
M2202	58	16:14:00.6	16:14:07.2	00:06.6	67	MC	3883449.6	139964.2	
M2203	58	16:17:54.9	16:17:58.2	00:03.3	60	-	3883417.0	141794.1	
M2204	58	16:18:22.9	16:18:24.5	00:01.6	57	-	3883413.2	142028.5	
M2205	58	16:18:50.3	16:18:52.4	00:02.1	65	D	3883409.4	142266.2	
M2206	58	16:19:40.1	16:19:41.8	00:01.7	87	-	3883402.8	142673.8	
M2207	58	16:19:48.9	16:19:50.0	00:01.1	100	+	3883401.6	142746.9	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M2208	58	16:20:47.0	16:20:48.1	00:01.1	93	+	3883393.7	143232.8	
M2209	58	16:20:53.6	16:20:55.3	00:01.7	67	+	3883392.8	143288.0	
M2210	58	16:21:46.2	16:21:48.9	00:02.7	53	+	3883385.7	143727.3	
M2211	58	16:22:58.5	16:23:40.1	00:41.6	149	MC	3883372.5	144546.9	
M2212	58	16:24:19.0	16:24:20.7	00:01.7	88	-	3883365.4	145002.1	
M2213	58	16:24:49.8	16:24:53.0	00:03.2	90	D	3883361.9	145262.1	
M2214	58	16:25:34.2	16:25:35.8	00:01.6	125	+	3883357.0	145615.6	
M2215	58	16:25:44.6	16:25:47.3	00:02.7	118	+	3883355.9	145700.5	
M2216	58	16:26:54.7	16:26:55.8	00:01.1	60	+	3883348.1	146273.7	
M2217	58	16:26:57.4	16:26:59.1	00:01.7	58	+	3883347.8	146295.7	
M2218	58	16:27:01.8	16:27:02.9	00:01.1	57	+	3883347.3	146331.7	
M2219	58	16:27:12.8	16:27:14.4	00:01.6	83	+	3883346.0	146425.5	
M2220	58	16:27:22.1	16:27:23.7	00:01.6	45	-	3883345.0	146497.0	
M2221	58	16:28:04.8	16:28:07.5	00:02.7	51	-	3883339.2	146849.8	
M2222	58	16:28:15.2	16:28:17.4	00:02.2	50	-	3883337.0	146938.6	
M2223	58	16:28:31.1	16:28:32.1	00:01.0	79	+	3883333.6	147074.0	
M2224	58	16:29:50.4	16:29:51.5	00:01.1	60	+	3883316.5	147752.0	
M2225	58	16:30:02.5	16:30:04.7	00:02.2	67	+	3883313.9	147854.9	
M2226	58	16:31:38.4	16:31:40.0	00:01.6	93	+	3883293.3	148674.3	
M2227	58	16:31:57.0	16:31:58.6	00:01.6	94	+	3883289.3	148833.1	
M2228	58	16:32:18.3	16:32:20.0	00:01.7	50	-	3883284.7	149015.5	
M2229	58	16:32:32.6	16:32:34.2	00:01.6	90	+.	3883281.7	149137.1	
M2230	58	16:32:39.6	16:32:42.9	00:03.3	108	D	3883280.1	149197.8	
M2231	58	16:32:45.1	16:32:47.3	00:02.2	113	-	3883279.0	149244.7	
M2232	58	16:33:11.9	16:33:13.0	00:01.1	113	+	3883273.2	149473.0	
M2233	58	16:33:50.7	16:33:51.8	00:01.1	107	+	3883264.9	149804.8	
M2234	58	16:33:52.4	16:33:54.0	00:01.6	67	-	3883264.5	149818.9	
M2235	58	16:34:26.9	16:36:12.6	01:45.7	1705	D	3883251.3	150343.2	
M2236	58	16:36:25.3	16:36:35.6	00:10.3	159	-	3883231.7	151125.1	
M2237	59	16:39:31.2	16:39:47.1	00:15.9	358	-	3883091.1	151603.6	
M2238	59	16:40:03.1	16:40:11.3	00:08.2	355	D	3883101.8	151210.6	
M2239	59	16:40:18.4	16:40:19.5	00:01.1	72	-	3883105.0	151091.9	
M2240	59	16:40:22.8	16:40:23.9	00:01.1	91	+	3883106.3	151044.2	
M2241	59	16:40:48.5	16:42:12.3	01:23.8	2417	MC	3883118.7	150586.7	
M2242	59	16:43:05.4	16:43:06.5	00:01.1	69	-	3883154.2	149281.2	
M2243	59	16:43:15.8	16:43:16.9	00:01.1	46	+	3883157.2	149168.4	
M2244	59	16:43:38.8	16:43:39.9	00:01.1	118	-	3883164.0	148919.1	
M2245	59	16:45:49.2	16:45:50.8	00:01.6	52	+	3883202.4	147504.9	
M2246	59	16:47:25.0	16:47:26.1	00:01.1	54	+	3883230.6	146465.3	
M2247	59	16:47:40.9	16:47:43.1	00:02.2	50	-	3883235.2	146292.9	
M2248	59	16:47:59.0	16:48:00.1	00:01.1	179	+	3883240.6	146096.7	
M2249	59	16:48:02.3	16:48:03.4	00:01.1	99	+	3883241.5	146061.0	
M2250	59	16:49:03.2	16:49:04.8	00:01.6	52	+	3883259.1	145400.7	
M2251	59	16:49:27.8	16:49:29.4	00:01.6	46	+	3883263.5	145129.2	
M2252	59	16:49:35.5	16:49:36.6	00:01.1	75	+	3883264.8	145044.3	
M2253	59	16:50:38.5	16:51:08.1	00:29.6	241	D	3883278.3	144198.2	
M2254	59	16:54:30.7	16:54:31.7	00:01.0	37	+	3883321.3	141714.8	
M2255	59	16:55:34.6	16:55:39.0	00:04.4	28	D	3883334.7	140952.4	
M2256	59	16:56:25.5	16:56:29.9	00:04.4	36	+	3883343.1	140403.3	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M2257	59	16:58:46.9	16:58:48.5	00:01.6	43	+	3883358.4	138798.1	
M2258	59	16:59:33.9	16:59:35.1	00:01.2	57	+	3883363.5	138263.5	
M2259	59	17:01:33.5	17:01:34.6	00:01.1	49	+	3883391.6	136930.7	
M2260	59	17:02:53.6	17:02:55.2	00:01.6	67	-	3883415.5	136047.3	
M2261	59	17:03:42.4	17:03:44.1	00:01.7	84	+	3883430.1	135507.6	
M2262	59	17:04:01.6	17:04:03.2	00:01.6	45	+	3883435.8	135296.3	
M2263	59	17:05:49.0	17:05:50.1	00:01.1	44	+	3883459.3	134117.6	
M2264	59	17:05:56.1	17:05:59.4	00:03.3	57	D	3883460.9	134015.9	
M2265	59	17:06:56.4	17:06:57.5	00:01.1	71	+	3883471.0	133380.0	
M2266	59	17:07:12.3	17:07:13.4	00:01.1	71	+	3883473.7	133206.9	
M2267	59	17:08:25.6	17:08:31.7	00:06.1	68	MC	3883486.9	132374.3	
M2268	60a	17:20:26.3	17:20:27.4	00:01.1	99	+	3883374.3	132820.2	
M2269	60a	17:21:31.4	17:21:44.6	00:13.2	75	MC	3883366.2	133391.0	
M2270	60a	17:25:02.9	17:25:04.1	00:01.2	59	+	3883348.7	134944.6	
M2271	60a	17:25:36.4	17:25:39.1	00:02.7	87	D	3883346.2	135193.9	
M2272	60a	17:28:09.8	17:28:10.8	00:01.0	117	+	3883329.2	136357.0	
M2273	60a	17:29:59.2	17:30:02.0	00:02.8	116	MC	3883305.0	137254.6	
M2274	60a	17:30:10.7	17:30:12.4	00:01.7	95	+	3883303.3	137337.4	
M2275	60a	17:30:42.5	17:30:44.7	00:02.2	77	D	3883298.1	137590.0	
M2276	60a	17:31:05.5	17:31:06.6	00:01.1	64	+	3883294.3	137773.5	
M2277	60a	17:32:37.0	17:32:38.1	00:01.1	80	+	3883279.2	138502.1	
M2278	60a	17:32:50.2	17:32:52.9	00:02.7	63	D	3883276.7	138619.9	
M2279	60a	17:32:57.3	17:32:58.9	00:01.6	57	-	3883275.8	138663.3	
M2280	60a	17:33:37.9	17:33:41.2	00:03.3	67	D	3883269.1	138986.8	
M2281	60a	17:34:01.5	17:34:03.1	00:01.6	111	+	3883265.2	139174.4	
M2282	60a	17:34:32.6	17:34:34.8	00:02.2	74	D	3883260.1	139422.6	
M2283	60a	17:34:32.6	17:34:34.8	00:02.2	74	D	3883260.1	139422.6	
M2284	60a	17:36:48.6	17:36:50.8	00:02.2	120	+	3883239.6	140499.0	
M2285	60a	17:37:05.0	17:37:06.1	00:01.1	67	-	3883239.9	140621.6	
M2286	60a	17:37:14.9	17:37:16.0	00:01.1	64	+	3883240.1	140695.1	
M2287	60a	17:38:00.4	17:38:01.5	00:01.1	46	-	3883240.9	141033.1	
M2288	60a	17:38:20.6	17:38:37.1	00:16.5	109	MC	3883241.4	141231.7	
M2289	60a	17:40:21.7	17:40:22.8	00:01.1	60	-	3883233.3	142113.6	
M2290	60a	17:40:26.1	17:40:27.2	00:01.1	60	+	3883232.7	142148.4	
M2291	60a	17:42:04.7	17:42:09.1	00:04.4	72	D	3883218.6	142942.1	
M2292	60a	17:42:22.9	17:42:26.7	00:03.8	69	D	3883215.9	143090.5	
M2293	60a	17:42:37.6	17:42:39.8	00:02.2	74	+	3883214.1	143189.8	
M2294	60a	17:43:05.2	17:43:06.9	00:01.7	65	+	3883210.2	143408.3	
M2295	60a	17:43:20.0	17:43:26.0	00:06.0	103	MC	3883207.9	143542.8	
M2296	60a	17:43:33.7	17:43:35.9	00:02.2	56	D	3883206.2	143633.8	
M2297	60a	17:44:15.9	17:44:31.2	00:15.3	190	-	3883199.1	144032.6	
M2298	60a	17:47:08.5	17:47:11.8	00:03.3	73	D	3883175.7	145346.8	
M2299	60a	17:47:27.6	17:47:29.8	00:02.2	81	+	3883173.0	145484.8	
M2300	60a	17:47:50.7	17:47:53.4	00:02.7	68	+	3883169.5	145666.4	
M2301	60a	17:48:09.9	17:48:11.0	00:01.1	41	+	3883166.5	145817.7	
M2302	60a	17:48:33.4	17:48:35.1	00:01.7	66	+	3883162.9	146003.2	
M2303	60a	17:49:55.4	17:49:56.5	00:01.1	60	+	3883150.3	146649.6	
M2304	60a	17:50:12.4	17:50:15.1	00:02.7	85	-	3883147.7	146783.5	
M2305	60a	17:50:24.5	17:50:27.8	00:03.3	113	D	3883145.6	146891.5	

Anom#	Line #	Start Time	End Time	Duration (seconds)	Gamma	Signature	X	Y	Correlations (with Sonar)
M2306	60a	17:50:53.0	17:50:54.6	00:01.6	126	+	3883141.5	147103.0	
M2307	60a	17:51:35.2	17:51:37.4	00:02.2	137	D	3883135.0	147436.0	
M2308	60a	17:52:51.5	17:52:53.6	00:02.1	132	+	3883123.3	148037.1	
M2309	60a	17:53:32.5	17:53:34.2	00:01.7	68	-	3883117.1	148368.3	
M2310	60a	17:53:57.7	17:53:58.8	00:01.1	68	+	3883113.3	148578.3	
M2311	60a	17:54:08.1	17:54:15.8	00:07.7	124	MC	3883111.2	148697.1	
M2312	60a	17:54:49.2	17:55:00.1	00:10.9	131	MC	3883105.1	149035.2	
M2313	60a	17:57:23.1	17:58:47.4	01:24.3	2843	D	3883073.3	150861.8	
M2314	60a	17:59:42.8	18:00:01.4	00:18.6	523	D	3883060.6	151514.9	
M2316	62	13:00:33.6	13:01:38.5	01:04.9	87	D	3882888.4	143284.9	
M2317	62	13:18:15.7	13:18:27.8	00:12.1	25	-	3882773.9	150155.0	
M2318	62	13:19:00.8	13:21:02.9	02:02.1	121	-	3882770.3	150454.5	
M2319	64	14:35:28.0	14:36:30.2	01:02.2	46.5	-	3882797.6	137123.6	
M2320	64	14:42:12.3	14:43:55.1	01:42.8	78.5	+	3882747.7	140021.7	
M2321	64	14:48:57.1	14:49:37.2	00:40.1	60	+	3882697.3	143106.5	
M2322	64	15:02:23.9	15:04:40.3	02:16.4	22	-	3882590.4	149912.7	
M2323	65	15:09:12.0	15:09:27.4	00:15.4	22	D	3882467.4	151454.6	
M2324	65	15:18:51.2	15:20:25.2	01:34.0	21.5	D	3882556.4	146734.5	
M2325	65	15:25:09.0	15:25:38.2	00:29.2	60.5	+	3882602.5	143223.7	
M2326	66	16:06:17.4	16:08:37.1	02:19.7	42.5	D	3882546.5	140538.8	
M2327	66	16:12:51.3	16:13:24.3	00:33.0	52	+	3882502.7	142999.0	
M2328	66	16:19:15.1	16:21:24.4	02:09.3	21.5	D	3882441.3	146456.7	
M2329	67	16:33:35.4	16:33:50.2	00:14.8	30	-	3882242.8	151540.5	
M2330	67	16:39:48.3	16:40:03.6	00:15.3	16	-	3882311.5	148393.6	
M2331	67	16:49:23.6	16:49:50.5	00:26.9	43	-	3882397.3	143163.7	
M2332	67	16:53:08.5	16:55:34.3	02:25.8	20	D	3882433.5	141053.4	
M2333	68	17:13:54.8	17:14:36.6	00:41.8	20	-	3882469.1	132681.9	
M2334	68	17:35:23.4	17:36:30.6	01:07.2	19.5	D	3882297.5	142963.2	
M2335	68	17:47:09.6	17:47:20.6	00:11.0	17	+	3882209.7	148316.4	

Table 10. Inventory of Acoustic Anomalies in SW Pass ODMDS Survey Area

Anomaly No.	Line No.	Disk No.	Disk %	Date	Time	Offset	Description	Correlation
A1	1	1	2%	9/29/99	12:33:15 - 12:33:18	131.8 - 136.2 ft strbd	Narrow linear anomaly running parallel to survey line	M22
A2	1	1	2%	9/29/99	12:35:18 - 12:35:20	54.4 - 70.3 ft strbd	Narrow linear anomaly approximately 15.9 ft long	
A3	2	1	6%	9/29/99	13:40:45 - 13:40:46	66.7 - 94.0 ft strbd	Very narrow linear anomaly with faint return	G"1" Bouy
A4	2	1	6%	9/29/99	13:41:07 - 13:41:10	72.9 - 99.3 ft strbrd	Irregularly-shaped cluster of anomalies of faint and hard returns	M121
A5	2	1	6%	9/29/99	13:42:19 - 13:42:23	61.5 - 99.3 ft strbrd	Irregularly-shaped cluster of anomalies of faint and hard returns	
A6	3	1	7%	9/29/99	13:58:19 - 13:58:20	24.1 - 59.7 ft strbrd	Linear anomaly extending from bottom surface into water column	G"1" Bouy M135
A7	4	1	13%	9/29/99	15:24:11 - 15:24:15	90.8 - 132.6 ft strbrd	Narrow linear anomaly extending from wider area of hard returns	G"1" Bouy
A8	5	1	15%	9/29/99	15:42:03 - 15:42:07	91.5 - 146.5 ft strbrd	Small irregularly-shaped anomaly with possible connecting drag mark	G"1" Bouy M264
A9	5	1	15%	9/29/99	15:49:50 - 15:49:54	138.4 - 145.8 ft strbrd	Pair of small, irregularly-shaped anomalies with medium reflectivity	
A10	9	1	30%	10/1/99	11:17:47 - 11:18:12	77.3 - 134.8 ft strbrd	Irregularly-shaped anomaly of medium to high reflectivity	G"3" Bouy M461
A11	12	1	35%	10/1/99	13:09:30 - 13:09:31	129.6 - 133.1 ft port	Small rectangular anomaly approximately 3 ft wide of medium replectivity	
A12	13	1	36%	10/1/99	13:16:07 - 13:16:21	110.7 - 131.2 ft strbrd	Cluster of medium reflectivity anomalies approximately 21 ft wide	
A13	13A	1	41%	10/1/99	14:32:23 - 14:32:35	64.4 - 113.1 ft strbrd	Cluster of medium to high reflectivity anomalies approximately 49 ft wide	
A14	14	1	41%	10/1/99	14:49:09 - 14:49:13	79.6 - 93.1 ft strbrd	Irregularly-shaped anomaly approximately 6 ft long of medium reflectivity	
A15	14	1	41%	10/1/99	14:51:05 - 14:51:07	86.2 - 92.6 ft port	Very small linear anomaly approximately 6 ft long of medium to high reflectivity.	

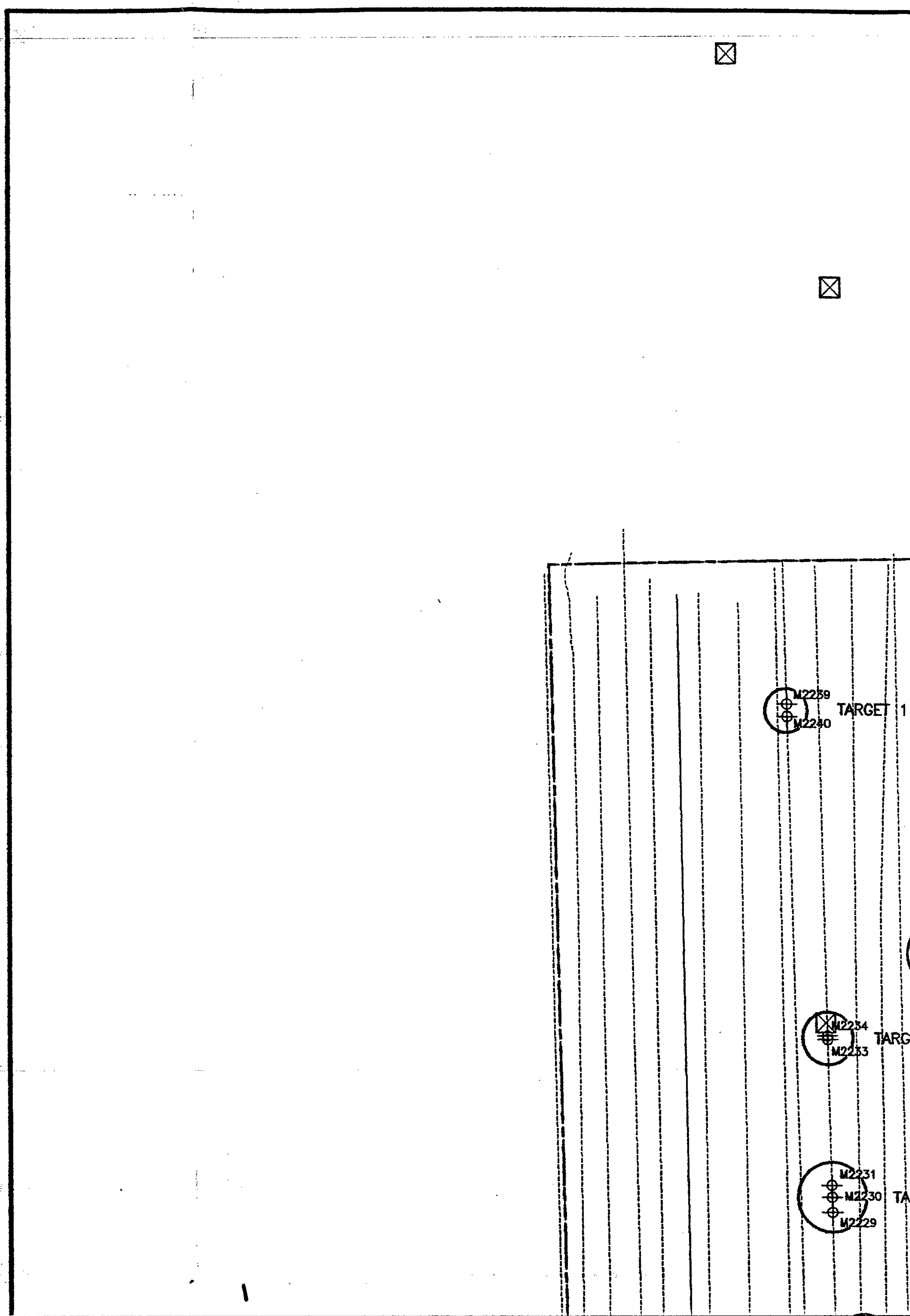
Anomaly No.	Line No.	Disk No.	Disk %	Date	Time	Offset	Description	Correlation
A16	19	1	56%	10/2/99	11:05:51 - 11:05:59	128.9 - 131.8 ft strbrd	Narrow oblong anomaly approximately 3 ft wide of medium to high reflectivity	
A17	19	1	56%	10/2/99	11:07:44 - 11:07:50	96.6 - 105.4 ft strbrd	Irregularly-shaped cluster of anomalies of medium reflectivity	
A18	22	1	62%	10/2/99	12:55:49 - 12:55:57	68.1 - 103.2 ft strbrd	Narrow linear anomaly approximately 35 ft long	M940
A19	22	1	62%	10/2/99	13:01:28 - 13:01:34	125.4 - 134.8 ft strbrd	Small, V-shaped anomaly of medium reflectivity.	M941
A20	22	1	62%	10/2/99	13:04:02 - 13:04:05	114.2 - 126.0 ft strbrd	Pair of small, irregularly-shaped anomalies with medium reflectivity	
A21	22	1	62%	10/2/99	13:07:20 - 13:07:21	130.7 - 134.8 ft strbrd	Very narrow linear anomaly approximately 4 ft long of medium to high reflectivity	
A22	22	1	63%	10/2/99	13:11:52 - 13:11:54	111.3 - 116.6 ft strbrd	Small, irregularly-shaped anomaly approximately 5 ft wide of medium reflectivity	
A23	23	1	66%	10/2/99	13:56:53 - 13:56:54	149.5 - 168.6 ft port	Narrow linear anomaly approximately 19 ft long of medium to high reflectivity	M976
A24	24	1	66%	10/2/99	14:18:06 - 14:18:11	87.4 - 100.2 ft strbrd	Narrow linear anomaly approximately 13 ft long of medium to high reflectivity	
A25	26	2	3%	10/2/99	15:48:21 - 15:48:26	57.4 - 87.9 ft strbrd	Narrow linear anomaly approximately 31 ft long of medium reflectivity	M1047
A26	26	2	3%	10/2/99	15:49:43 - 15:49:44	118.4 - 127.8 ft port	Rectangular anomaly approximately 9 ft long of medium reflectivity	
A27	26	2	3%	10/2/99	15:51:16 - 15:51:21	78.6 - 159.5 ft port	Wide linear anomaly approximately 81 ft long of medium reflectivity	M1049
A28	26	2	3%	10/2/99	15:51:48 - 15:51:53	80.9 - 118.4 ft port	Narrow linear anomaly approximately 38 ft long of medium to high reflectivity	
A29	28	2	7%	10/2/99	17:07:34 - 17:08:58	91.4 - 152.4 ft strbrd	Series of five narrow linear anomalies ranging in length from approximately 45 - 82 ft long of medium to high reflectivity	M1138

Anomaly No.	Line No.	Disk No.	Disk %	Date	Time	Offset	Description	Correlation
A30	29A	2	11%	10/2/99	18:15:48 - 18:15:59	65.6 - 70.3 ft strbrd	Narrow linear anomaly approximately 4.7 ft wide of medium reflectivity	
A31	30A	2	12%	10/3/99	10:18:59 - 10:19:09	96.2 - 111.4 ft port	Narrow, curved, linear anomaly approximately 6 ft wide of medium to high reflectivity	
A32	32A	2	17%	10/3/99	11:46:05 - 11:46:06	145.3 - 152.4 ft strbrd	Small rectangular anomaly approximately 7 ft wide of medium replectivity	
A33	33A	2	20%	10/3/99	12:29:04 - 12:29:07	124.2 -133.6 ft strbrd	Small square anomaly approximately 9 x 9 ft of medium reflectivity	
A34	34	2	20%	10/3/99	12:43:56 - 12:44:18	18.7 - 117.2 ft strbrd	Narrow linear anomaly approximately 99 ft long of medium to high reflectivity	M1325
A35	35A	2	24%	10/3/99	14:16:34 - 14:17:08	59.7 - 165.3 ft strbrd	Pair of narrow linear anomalies ranging in length from approximately 46 - 107 ft long of medium to high reflectivity	M1353
A36	35A	2	25%	10/3/99	14:18:47 - 14:18:58	160.6 - 173.5 strbrd	Pair of small, irregularly-shaped anomalies approximately 13 ft wide of medium reflectivity	M1354
A37	36	2	25%	10/3/99	14:40:06 - 14:40:11	138.3 - 168.8 ft strbrd	Narrow linear anomaly approximately 31 ft long of medium reflectivity	M1363
A38	36	2	25%	10/3/99	14:40:45 - 14:40:48	112.5 - 131.2 ft strbrd	Narrow linear anomaly approximately 19 ft long of medium to high reflectivity	
A39	36	2	25%	10/3/99	14:41:28 - 14:41:48	23.4 - 131.2 ft strbrd	Narrow linear anomaly approximately 108 ft long of medium reflectivity	
A40	38	2	30%	10/3/99	16:20:57 - 16:20:58	72.6 - 92.5 ft strbrd	Narrow linear anomaly approximately 20 ft long of medium to high reflectivity	
A41	38	2	30%	10/3/99	16:21:26 - 16:21:30	42.1 - 56.2 ft strbrd	Small rectangular anomaly approximately 14 ft wide of medium to high reflectivity	M1388

Anomaly No.	Line No.	Disk No.	Disk %	Date	Time	Offset	Description	Correlation
A42	38	2	30%	10/3/99	16:21:31 - 16:21:36	25.8 - 56.3 ft port	Narrow linear anomaly approximately 31 ft long of high reflectivity	M1389
A43	38	2	31%	10/3/99	16:33:46 - 16:33:51	100.8 - 112.5 ft strbrd	Narrow linear anomaly approximately 4 ft wide of medium reflectivity	
A44	39	2	35%	10/3/99	17:34:07 - 17:34:11	36.3 - 73.8 ft strbrd	Irregularly-shaped cluster of anomalies approximately 38 ft wide of medium to high reflectivity	
A45	40A	2	35%	10/4/99	9:44:46 - 9:46:07	56.3 ft port - 180.5 ft starboard	Series of three linear anomalies ranging in length from approximatey 35 - 59 ft and of medium to high reflectivity	M1432
A46	41	2	39%	10/4/99	10:43:08 - 10:43:18	63.2 - 93.7 ft strbrd	Narrow linear anomaly running parallel to survey line	M1547
A47	42	2	40%	10/4/99	10:57:32 - 10:57:49	164.1 - 241.5 ft strbrd	Narrow linear anomaly approximately 77 ft long of medium reflectivity	
A48	42	2	40%	10/4/99	10:57:37 - 10:57:42	18.8 - 76.2 ft port	Irregularly-shaped cluster of small anomalies approximately 57 ft wide of high reflectivtiy	
A49	43	2	43%	10/4/99	11:52:52 - 11:53:02	123.1 - 134.9 ft port	Narrow linear anomaly approximately 4 ft wide of medium reflectivity	
A50	43A	2	44%	10/4/99	12:06:10 - 12:06:19	76.1 - 198.1 ft strbrd	Irregularly-shaped anomaly approximately 122 ft long of high reflectivity	possible barge M1625
A51	46	2	48%	10/4/99	13:22:18 - 13:22:37	92.6 ft port - 146.5 ft strbrd	Wide linear anomaly of high reflectivity crossing survey line	
A52	47	2	52%	10/4/99	14:18:03 - 14:18:31	24.6 - 85.6 ft port	Irregularly-shaped anomaly of medium to high reflectivity	possible barge
A53	49	2	56%	10/4/99	15:26:11 - 15:26:17	43.3 - 141.8 ft strbrd	Narrow linear anomaly approximately 90 ft long of medium reflectivity	
A54	49	2	56%	10/4/99	15:26:43 - 15:27:13	62.2 ft port - 158.2 ft strbrd	Area of small, scattered anomalies on both sides of the survey line exhibiting small shadows	M1867

Anomaly No.	Line No.	Disk No.	Disk %	Date	Time	Offset	Description	Correlation
A55	51A	2	60%	10/4/99	16:42:40 - 16:43:06	28.0 - 56.2 ft strbrd	Narrow linear anomaly of high reflectivity running parallel to survey line	
A56	51A	2	60%	10/4/99	16:44:54 - 16:44:60	63.3 ft strbrd - 66.7 ft port	Narrow linear anomaly approximately 133 ft long of medium reflectivity and crossing the survey line	
A57	53B	3	2%	10/6/99	12:16:27 -12:16:39	121.9 - 162.9 ft strbrd	Narrow linear anomaly approximately 41 ft long of medium reflectivity	
A58	55	3	5%	10/6/99	13:55:25 - 13:55:36	22.3 - 102.0 ft port	Narrow linear anomaly approximately 80 ft long of medium reflectivity	
A59	55	3	5%	10/6/99	13:57:57 - 13:58:10	69.2 ft port - 72.6 ft strbrd	Pair of linear anomalies approximately 142 ft wide of very high reflectivity crossing survey line	Possible barge
A60	56	3	8%	10/6/99	14:48:40 - 14:48:46	43.3 - 72.6 ft strbrd	Irregularly-shaped area of very high reflectivity approximately 29 ft wide	M2112
A61	56	3	8%	10/6/99	14:54:21 - 14:54:32	58.5 - 77.3 ft strbrd	Narrow linear anomaly of medium reflectivity running nearly parallel to survey line	M2122
A62	56	3	9%	10/6/99	15:01:50 - 15:01:55	21.1 - 62.2 ft port	Narrow linear anomaly approximately 41 ft long of high reflectivity	
A63	57	3	10%	10/6/99	15:37:47 - 15:37:51	53.8 - 62.1 ft strbrd	Small rectangular anomaly approximately 4 ft wide of very high reflectivity	
A64	58	3	12%	10/6/99	16:11:04 - 16:11:12	102.0 - 124.3 ft port	Narrow linear anomaly approximately 22 ft long of medium reflectivity	M2197
A65	58	3	12%	10/6/99	16:11:19 - 16:11:26	105.5 - 114.9 ft port	Narrow linear anomaly of medium reflectivity running nearly parallel to survey line	
A66	58	3	13%	10/6/99	16:30:38 - 16:30:42	38.7 - 42.2 ft port	Small rectangular anomaly approximately 4 ft wide of very high reflectivity	

Anomaly No.	Line No.	Disk No.	Disk %	Date	Time	Offset	Description	Correlation
A67	58	3	13%	10/6/99	16:31:10 - 16:31:13	58.5 - 113.7 ft port	Narrow linear anomaly approximately 55 ft long of high reflectivity	
A68	60	3	15%	10/6/99	17:12:06 - 17:12:09	151.3 - 161.8 ft port	Small rectangular anomaly approximately 11 ft wide of high reflectivity	
A69	61	3	31%	11/29/99	11:32:59 - 11:33:01	13.2 - 20.7 ft strbd	Small oblong shaped anomaly with med. high reflectivity	
A70	61	3	31	11/29/99	11:37:53 - 11:37:58	Port to Strbd	Straight anomaly running perpendicular to survey line, possibly a boat wake, trawl scar or pipeline.	
A71	62	3	38	11/29/99	13:13:07 - 13:13:08	29.9 - 36.2 strbd	Small linear anomaly approximately 7 ft. long.	
A72	63	3	39	11/29/99	13:32:03 - 13:32:05	26.7 - 41.2 port	Small, oblong, poorly defined anomaly with medium to high reflexivity	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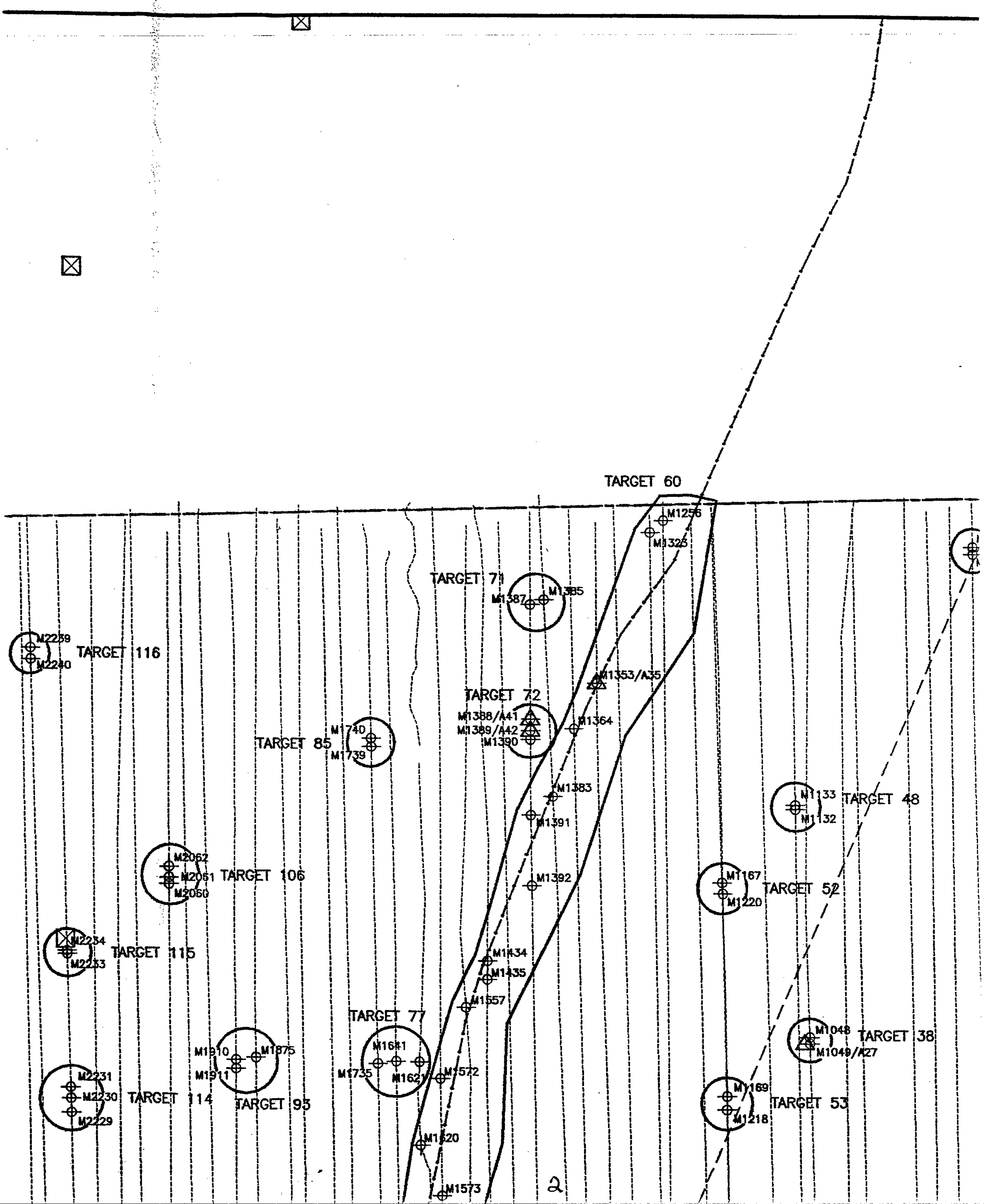
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TARGET 72
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M1389/A42
M1390
M1364
M1740
M1739
TARGET 85
M1383
M1391
M1133
M1132
TARGET 48
M2062
M2061
M2060
TARGET 106
M1392
M1167
M1220
TARGET 52
M2234
M2233
TARGET 115
M1434
M1435
M1557
TARGET 77
M1048
M1049/A27
TARGET 38
M1910
M1911
M1875
M1641
M1735
M1621
M1572
M2231
M2230
M2229
TARGET 114
TARGET 93
M1169
M1218
TARGET 53
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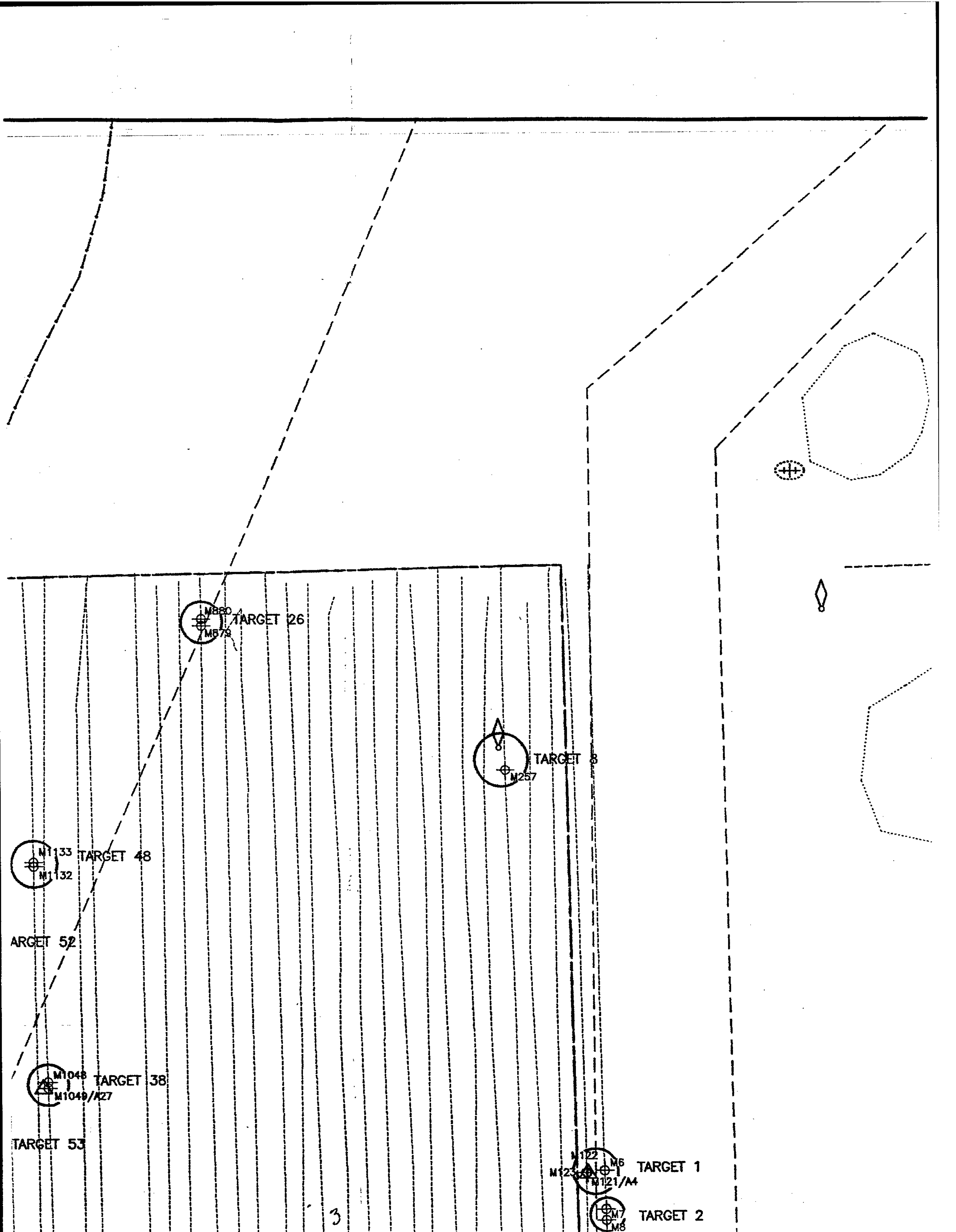
M1573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M579
TARGET 8
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M1133
TARGET 48
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ARGET 52
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TARGET 38
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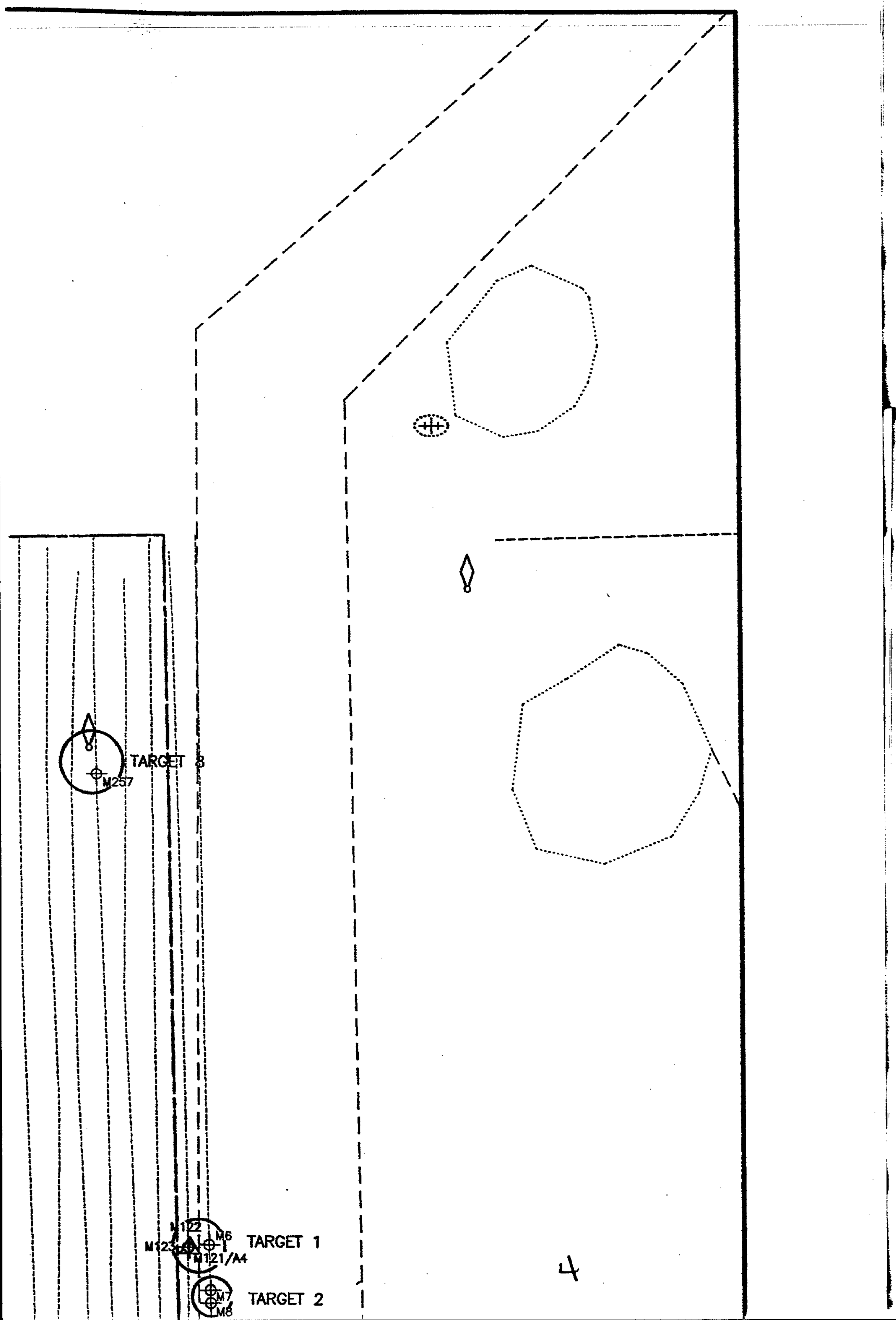
M121/A4
M7
TARGET 2
M8



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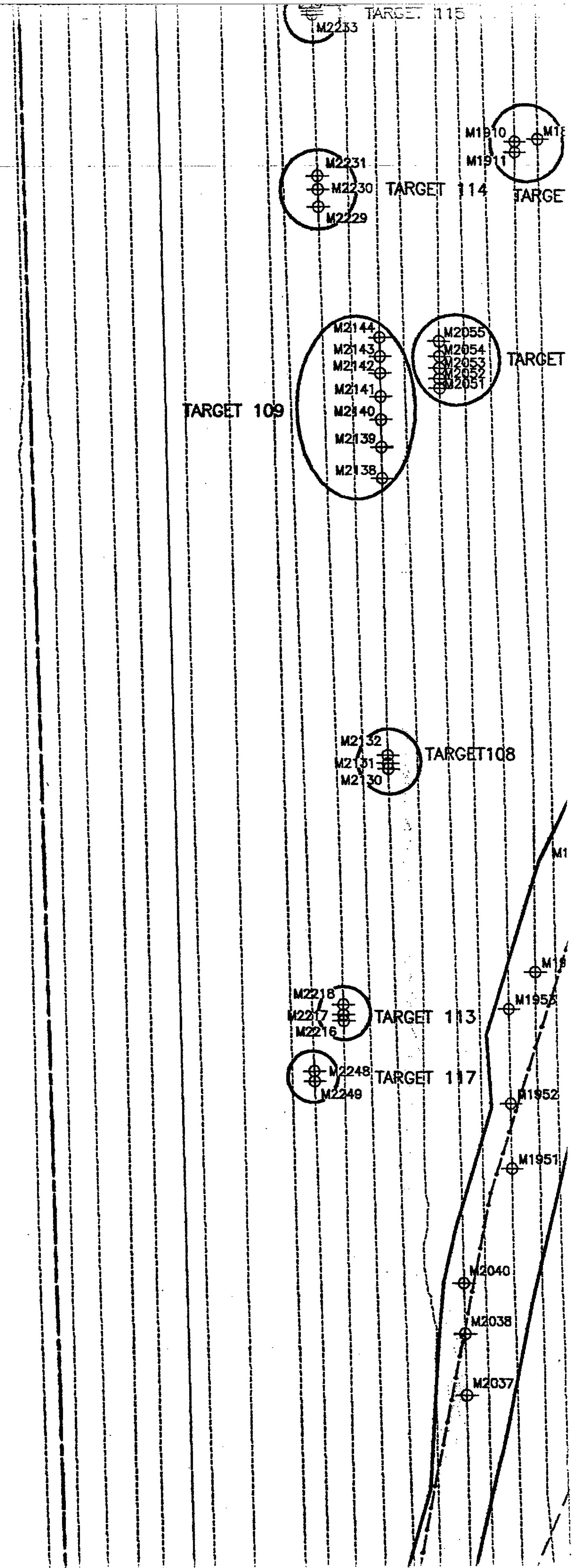

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M1911
M2231
M2230
M2229
TARGET 114
TARGET 109
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M2141
M2140
M2139
M2138
M2055
M2054
M2053
M2052
M2051
TARGET
M2132
M2131
M2130
TARGET108
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TARGET 113
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TARGET 117
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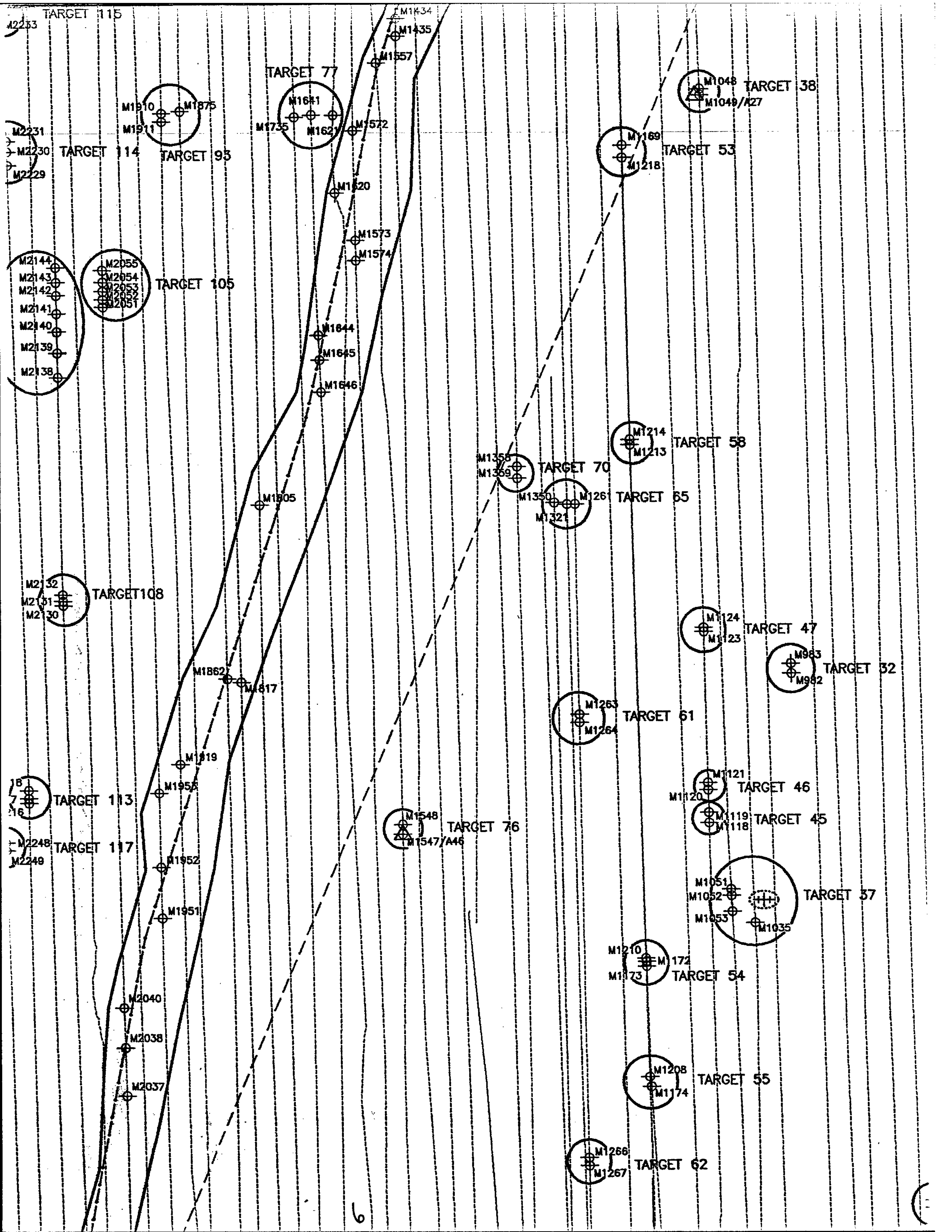
M2038
M2037



TARGET 115
M2233
M1434
M1435
M1557
TARGET 77
M1641
M1735
M1621
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M1910
M1875
M1911
TARGET 93
M2231
M2230
TARGET 114
M2229
M1048
TARGET 38
M1049/A27
M1169
TARGET 53
M1218
M1620
M1573
M1574
M2144
M2143
M2142
M2141
M2140
M2139
M2138
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M2051
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M1646
M1214
TARGET 58
M1213
M1358
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TARGET 70
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TARGET 65
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M2131
M2130
TARGET108
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TARGET 47
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TARGET 32
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TARGET 61
M1264
M1919
M1953
TARGET 113
M1121
TARGET 46
M1120
M1119
TARGET 45
M1118
M1548
TARGET 76
M1547/A46
M2248
TARGET 117
M2249
M1952
M1051
M1052
TARGET 37
M1053
M1035
M1951
M1210
M1172
M1173
TARGET 54
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M2038
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TARGET 55
M1174
M2037
M1266
TARGET 62
M1267
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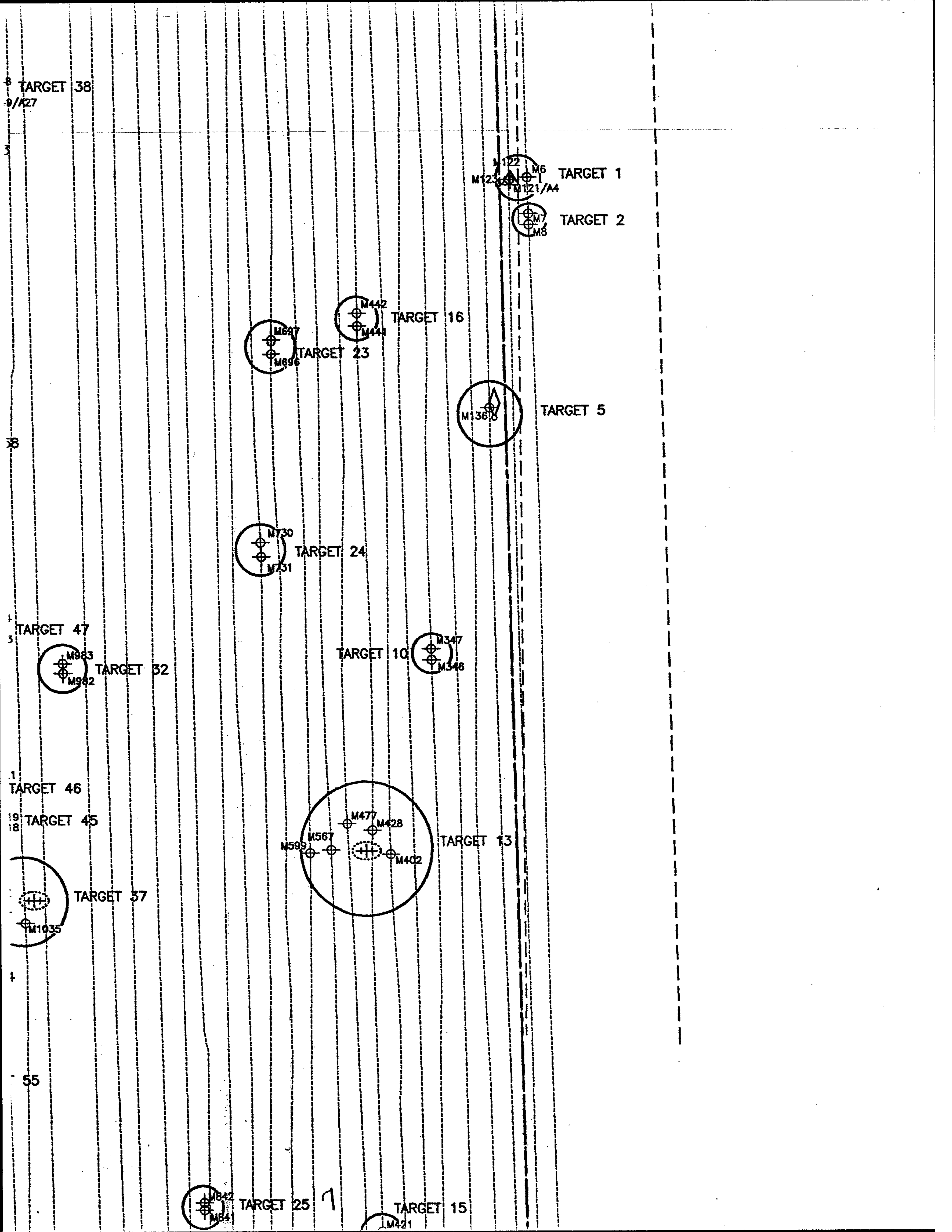
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M6
TARGET 1
M123
M121/A4
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TARGET 2
M8
M442
TARGET 16
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TARGET 23
M696
TARGET 5
M136
M730
TARGET 24
M731
TARGET 47
M983
TARGET 32
M982
TARGET 10
M347
M346
TARGET 46
TARGET 45
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M567
M599
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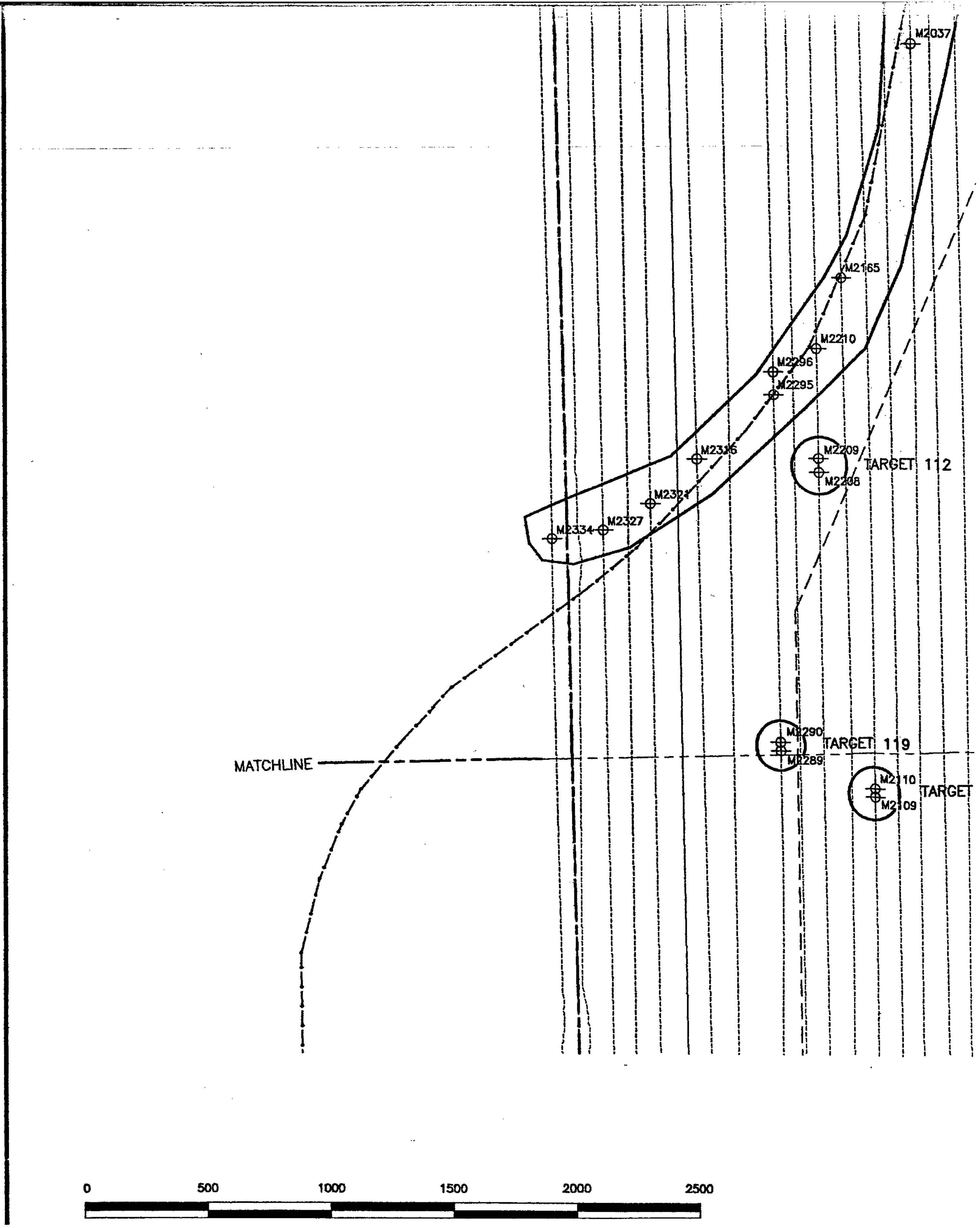
M402
TARGET 37
M1035
55
M842
TARGET 25
M841
TARGET 15
M421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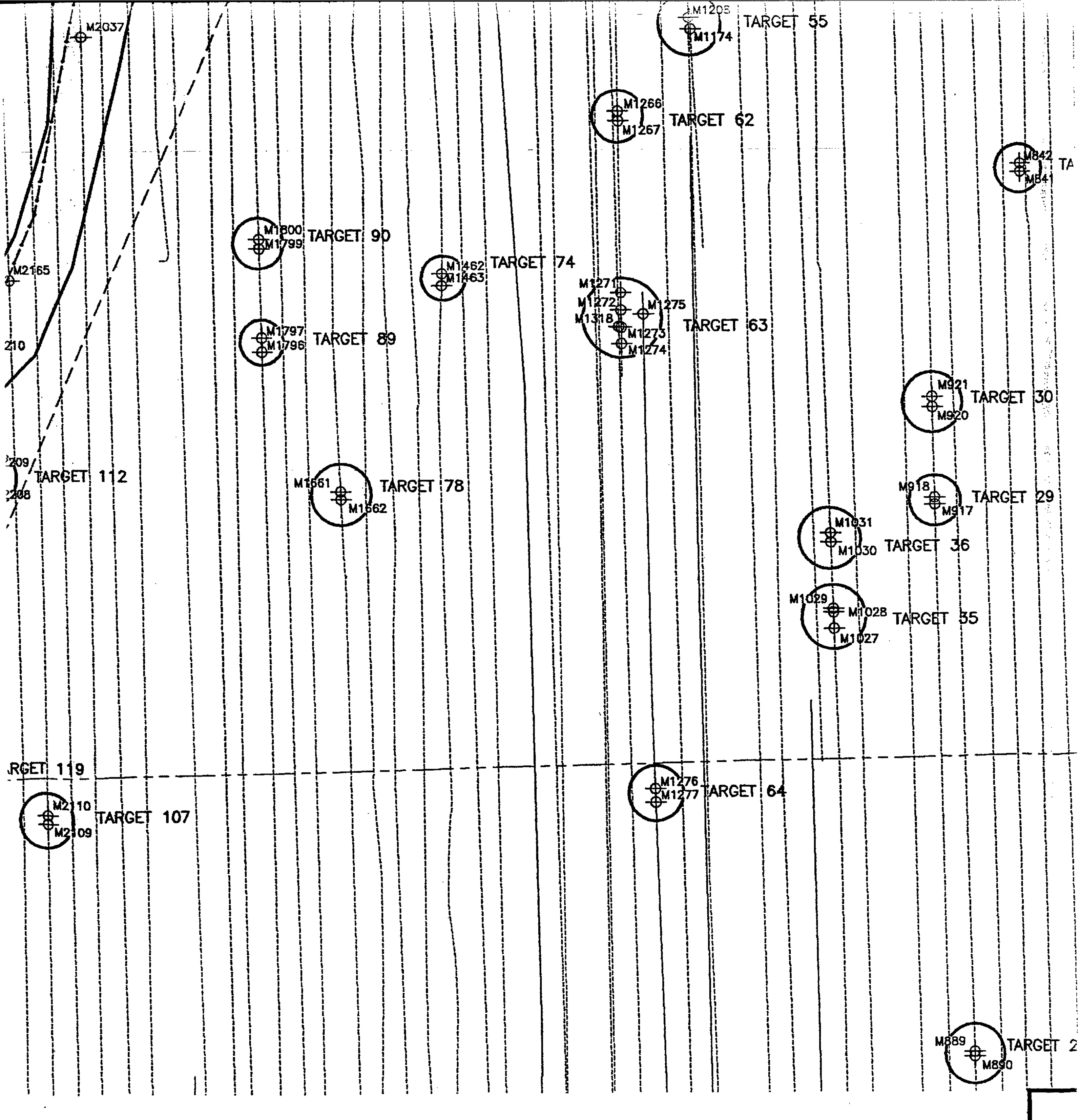
1500
2000
2500



M2037
M1205
TARGET 55
M1174
M1266
TARGET 62
M1267
M842
M841
M1800
TARGET 90
M1799
M2165
M1462
TARGET 74
M1463
M1271
M1272
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TARGET 63
M1273
M1274
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TARGET 89
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M921
TARGET 30
M920
TARGET 112
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TARGET 78
M1662
M918
TARGET 29
M917
M1031
M1030
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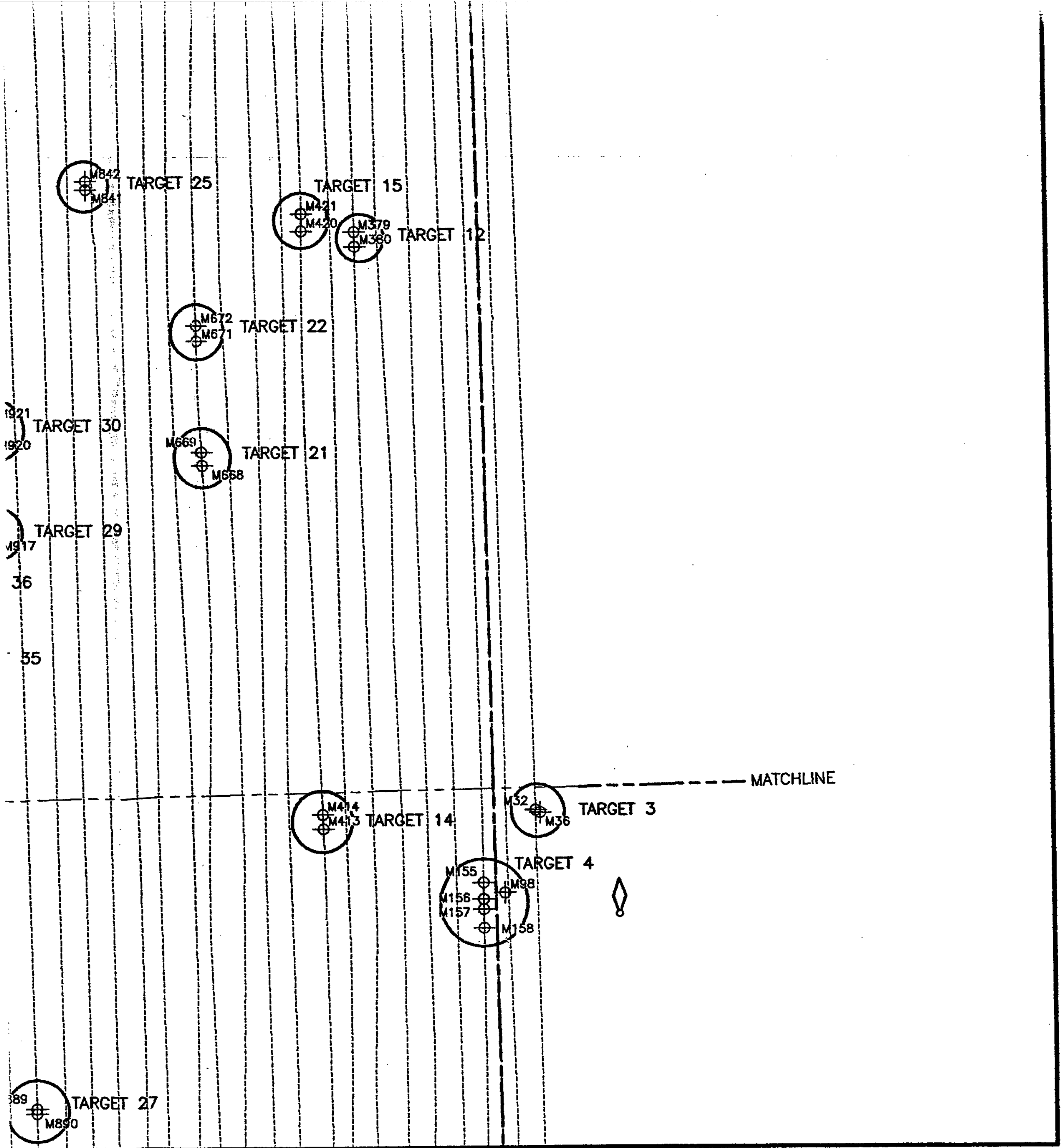
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TARGET 30
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M668
TARGET 29
36
35
MATCHLINE
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M36
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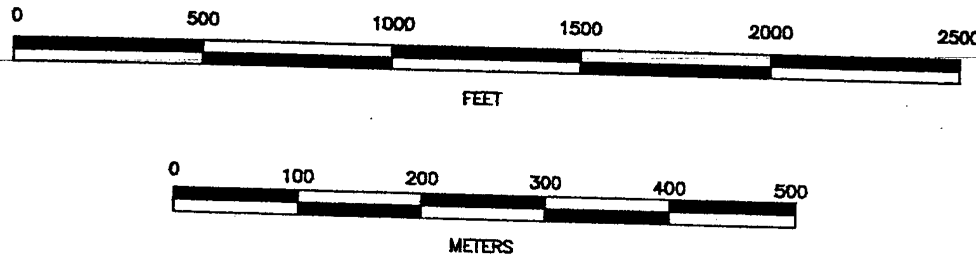
TARGET 4
M155
M156
M157
M98
M158
TARGET 27
M890

10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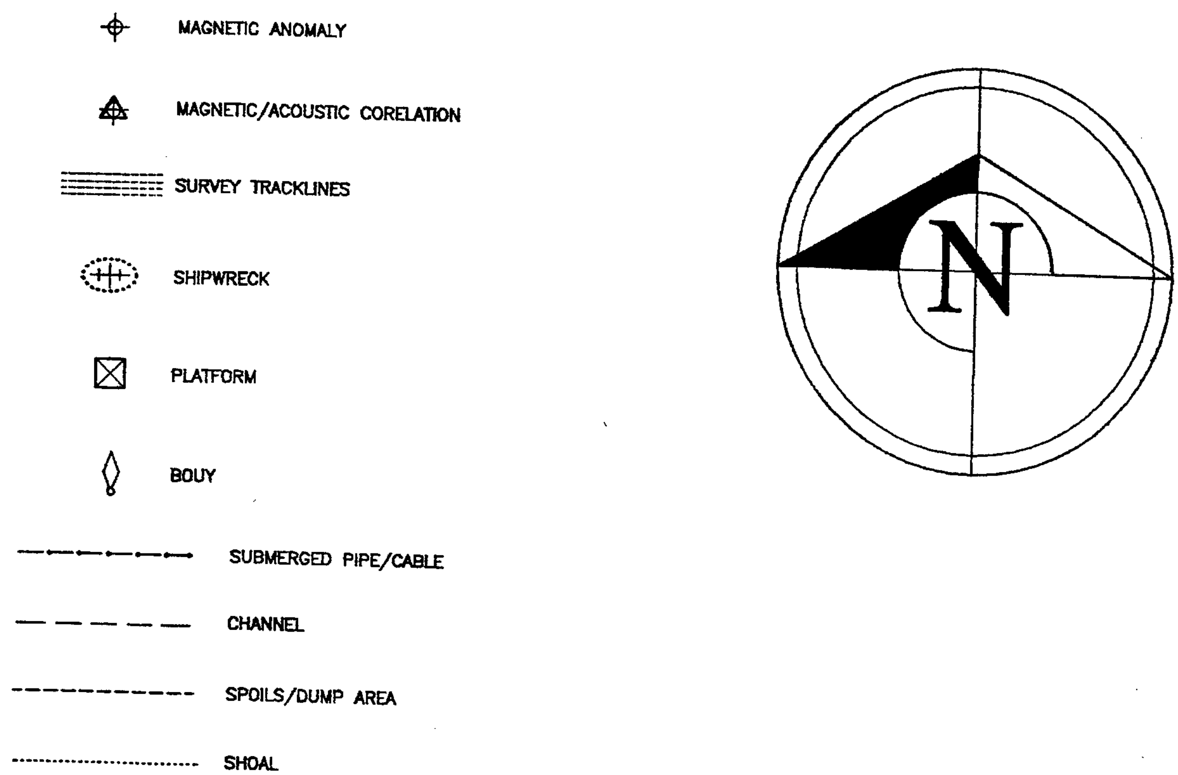
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MAGNETIC/ACOUSTIC CORELATION
SURVEY TRACKLINES
SHIPWRECK
PLATFORM
BOUY
SUBMERGED PIPE/CABLE
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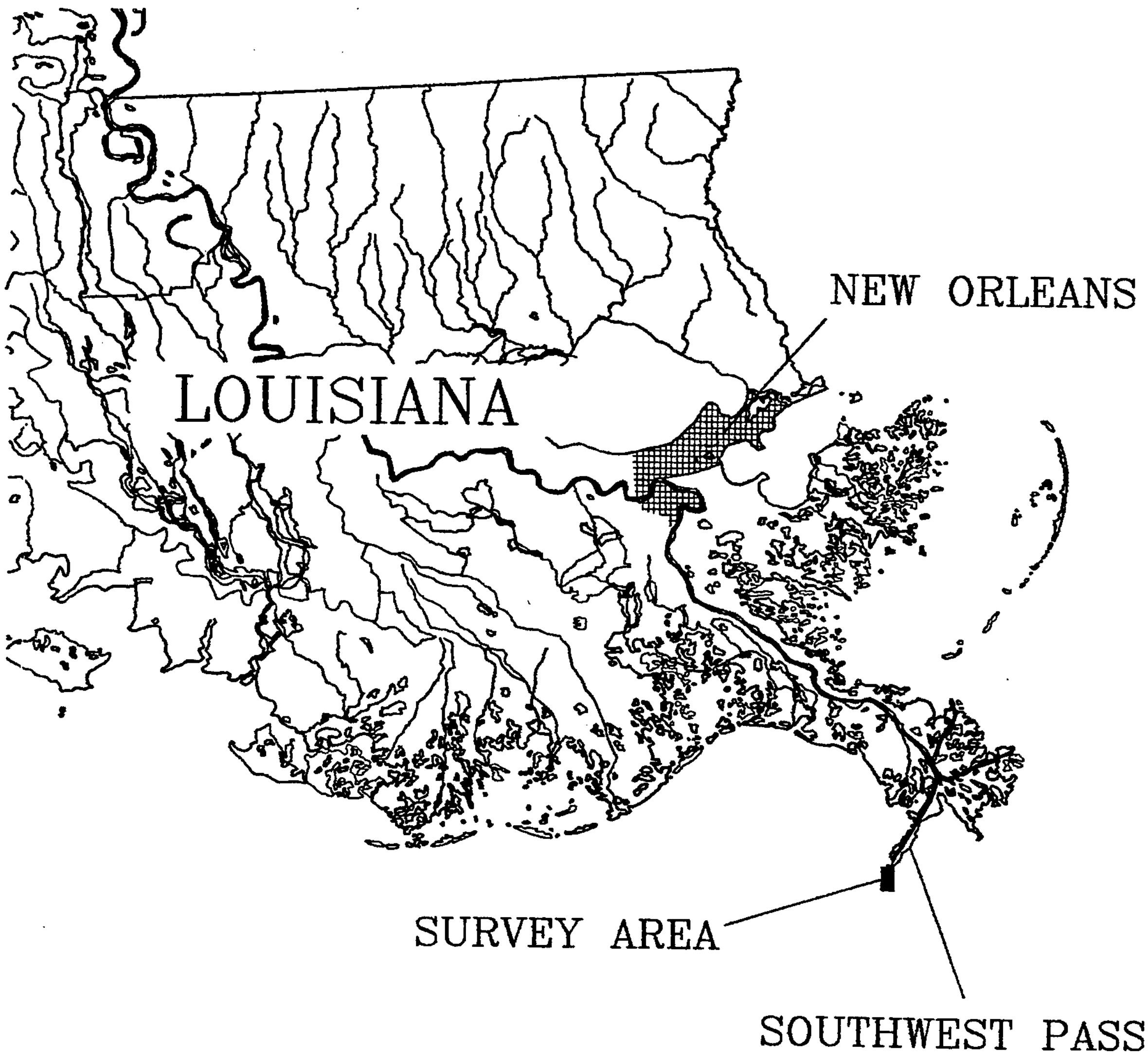
SHOAL
N


NEW ORLEANS
LOUISIANA
SURVEY AREA
SOUTHWEST PASS

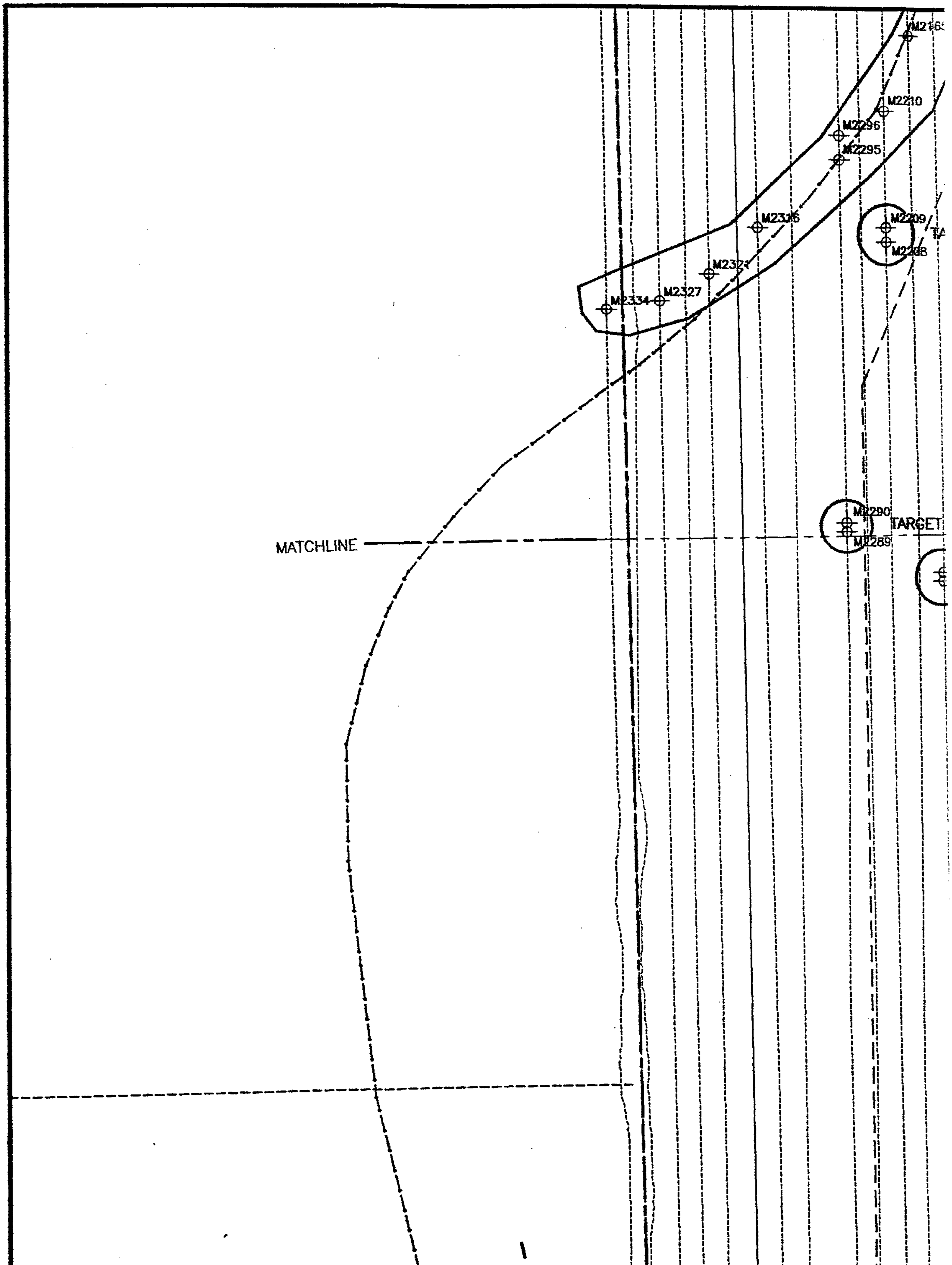
EANS

PASS

SOUTHWEST PASS ODMDS

Location of Targets Within the Survey Area

DATE: JANUARY 2000	DRAWN BY: BW
SHEET 1 of 2	R. CHRISTOPHER GOODWIN & ASSOCIATES, INC. 241 EAST FOURTH STREET, FREDERICK, MARYLAND 21701 1.301.694.0428



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M2316
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M2321
M2327
M2334
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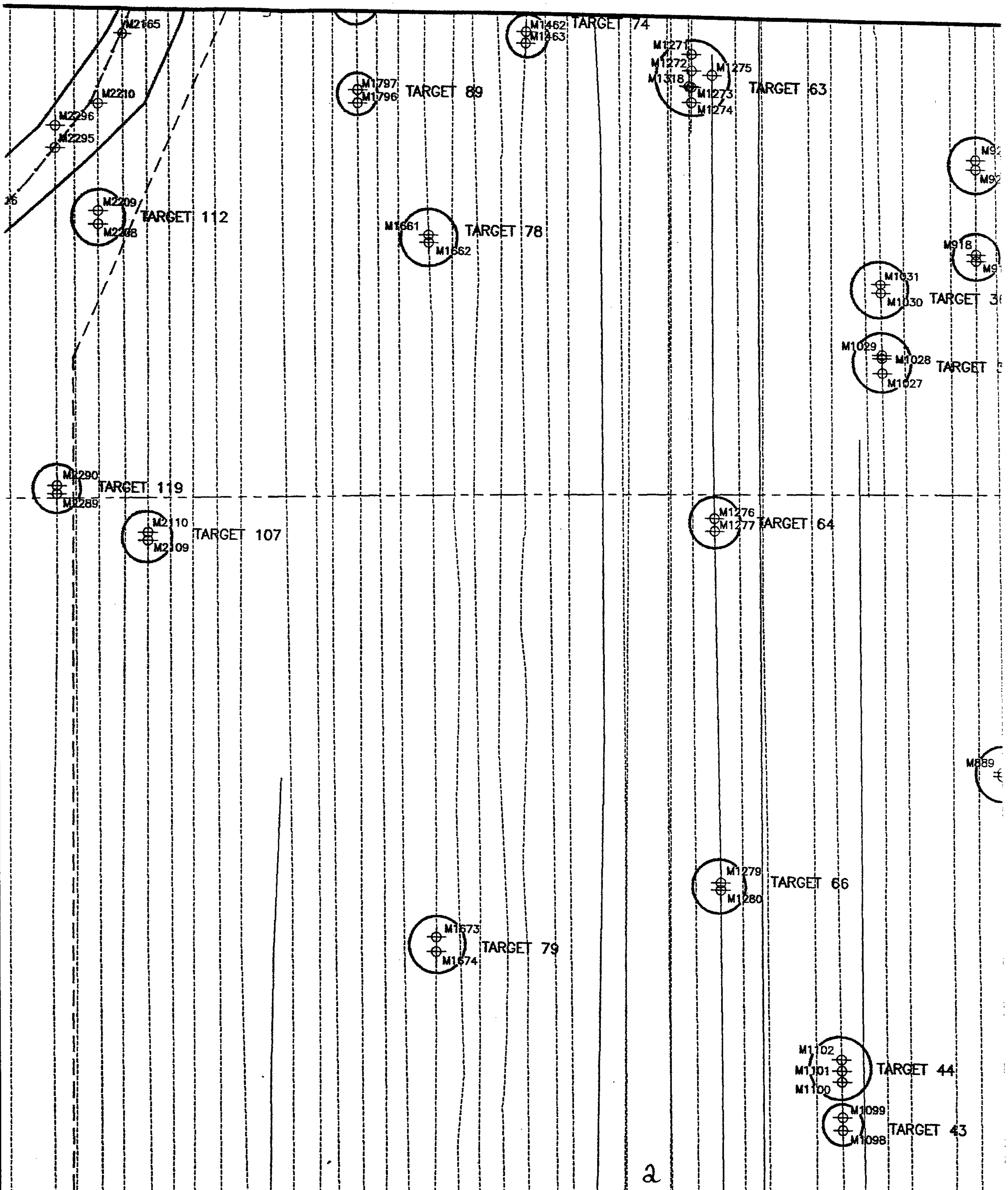
TARGET
M2289
MATCHLINE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TARGET 89
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TARGET 119
M2110
M2109
TARGET 107
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TARGET 44
M1099
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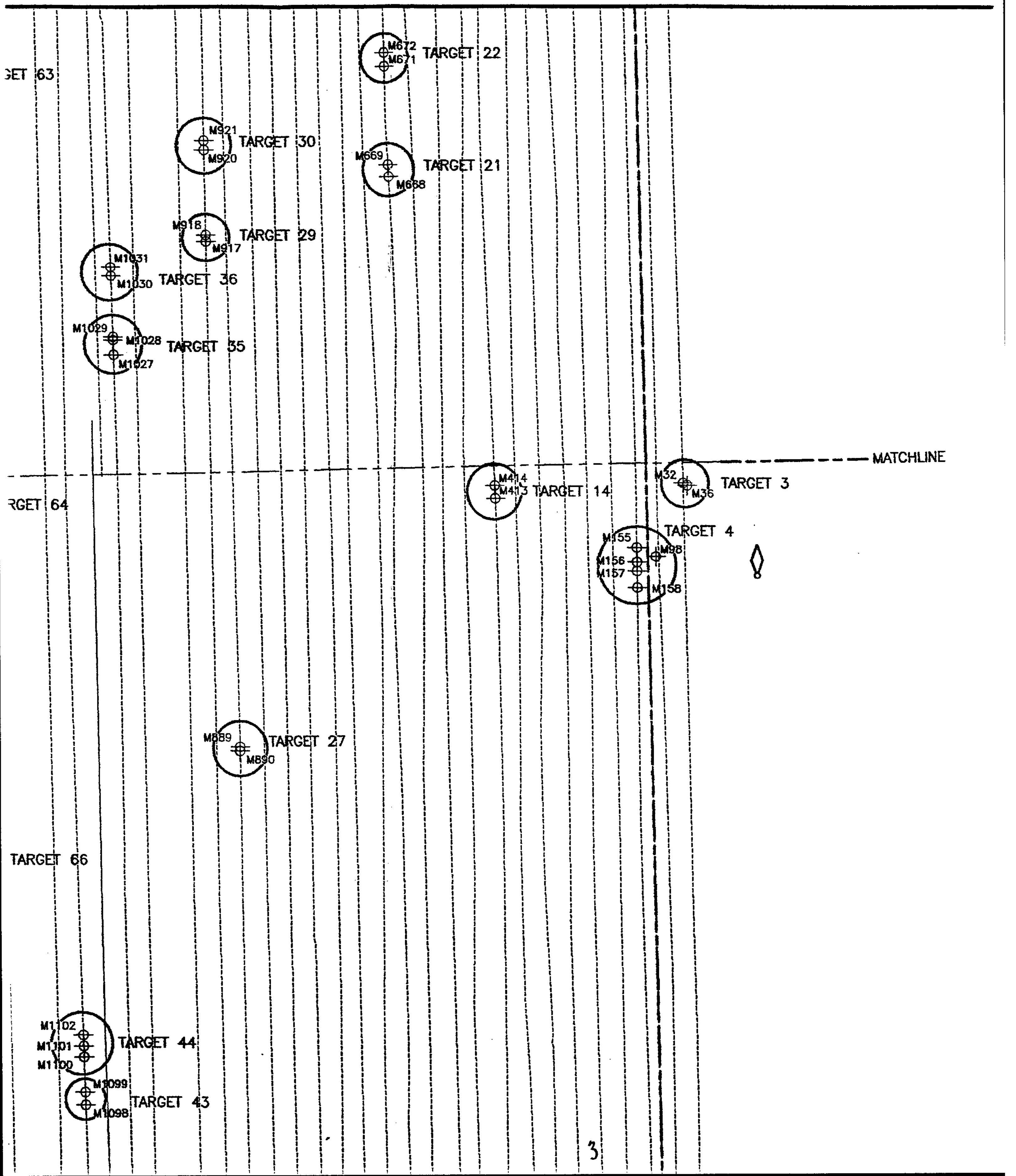
TARGET 43



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GET 63
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M920
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TARGET 29
M918
M917
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M1031
M1030
TARGET 35
M1029
M1028
M1027
MATCHLINE
TARGET 14
M414
M413
TARGET 3
M32
M36
RGET 64
TARGET 4
M155
M156
M157
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M98
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M890
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TARGET 43
M1099
M1098
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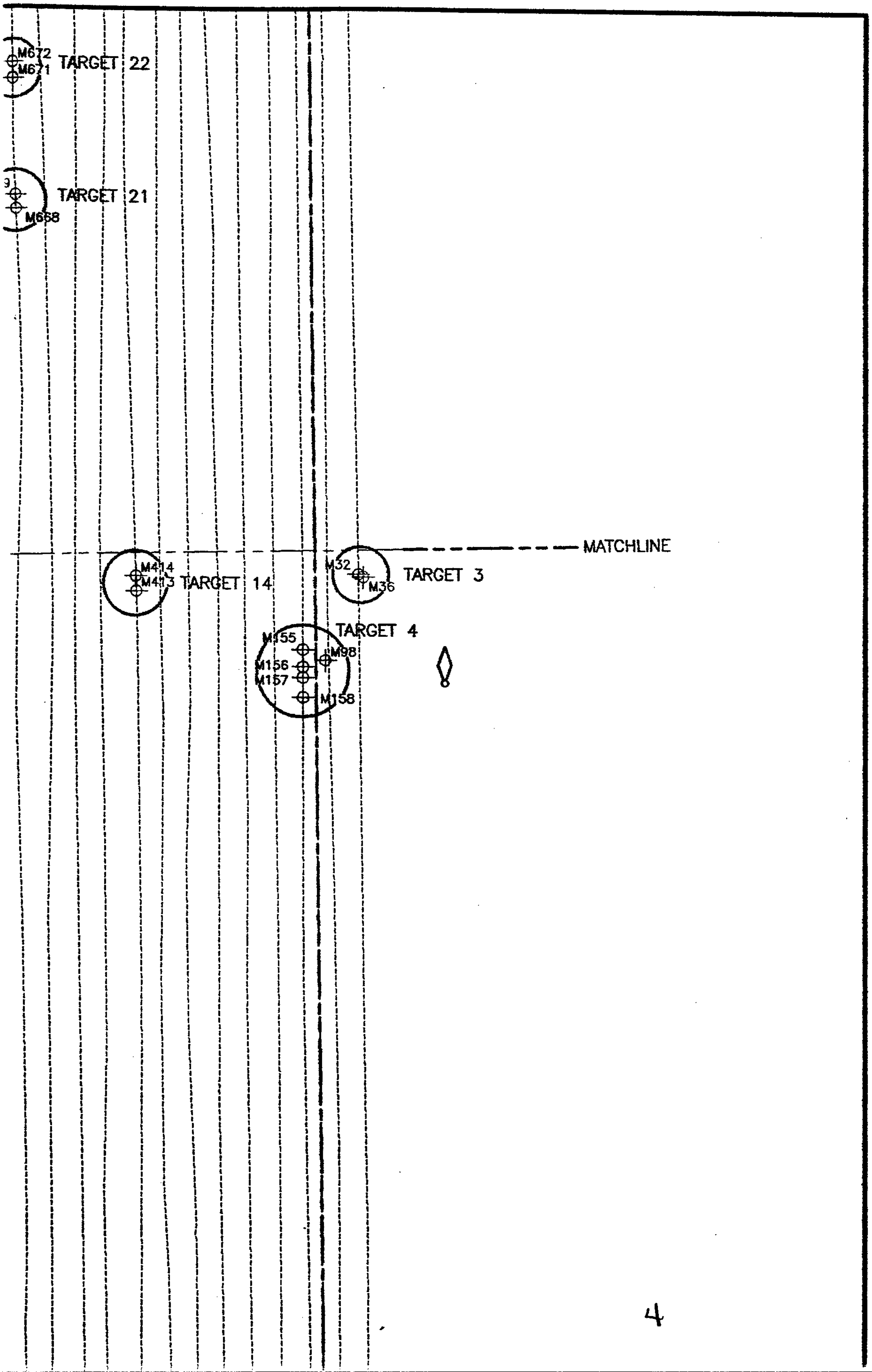
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TARGET 4
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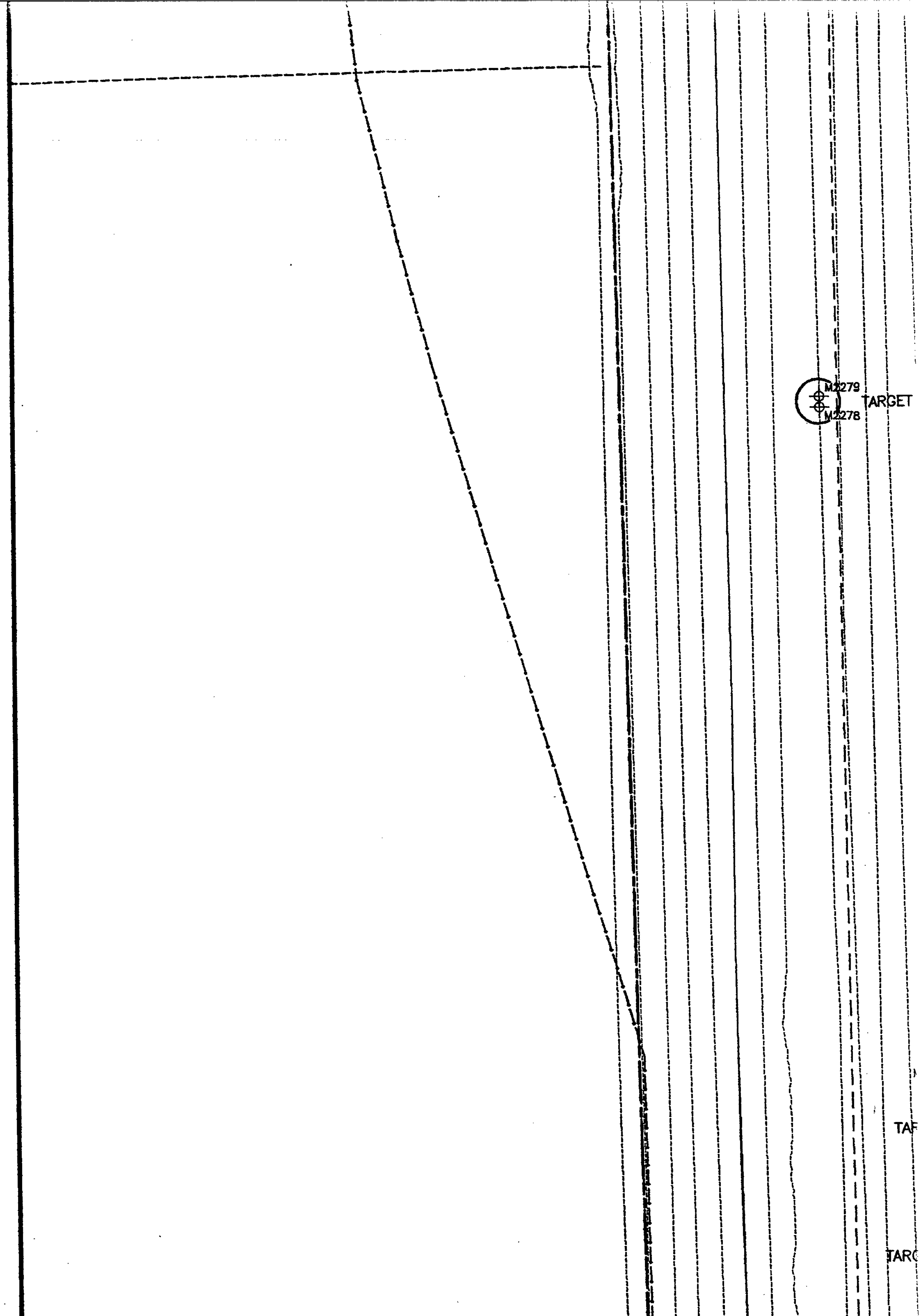
M98
M158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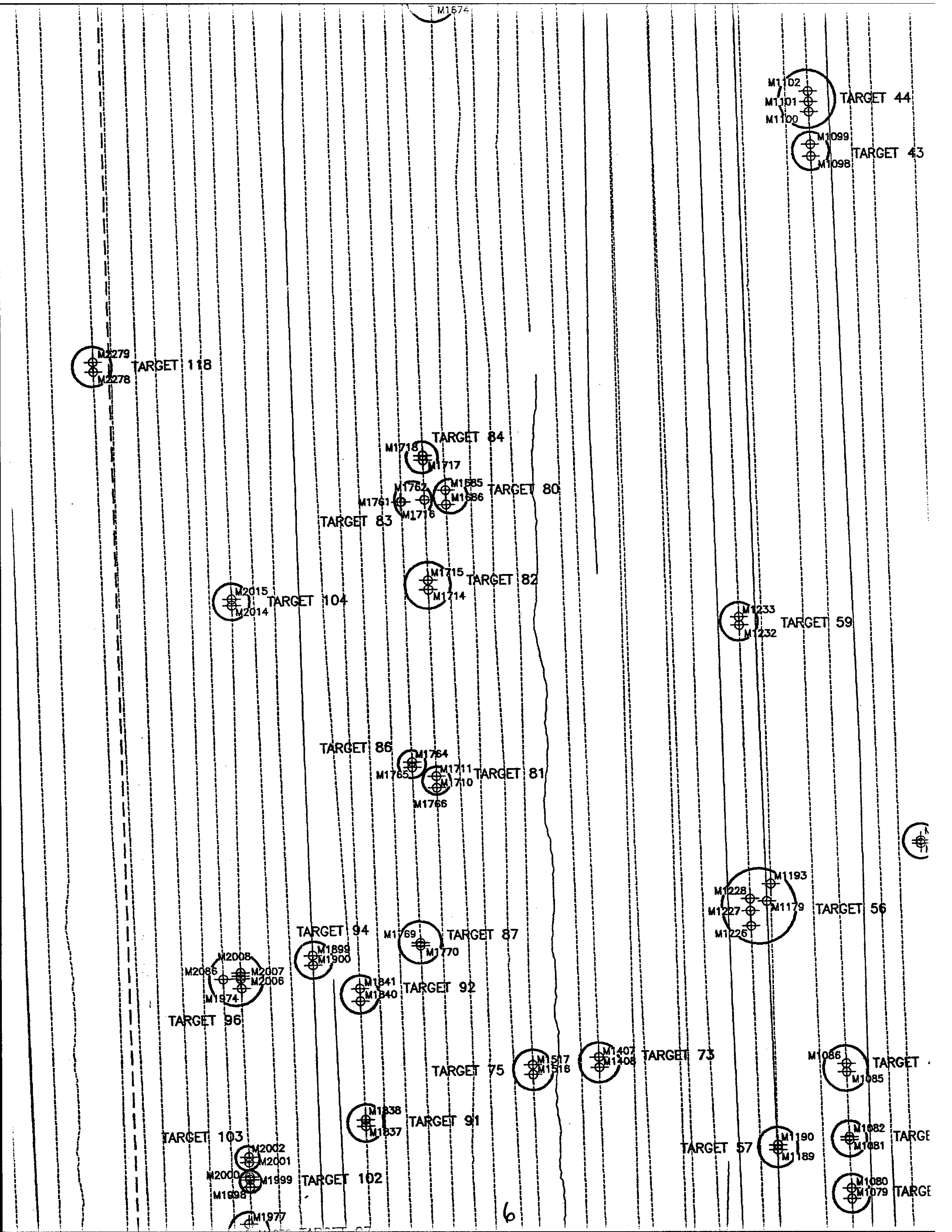

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M1100
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M1098
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M2279
M2278
TARGET 118
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TARGET 83
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TARGET 104
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TARGET 59
TARGET 86
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M1711
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TARGET 81
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M1227
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TARGET 56
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TARGET 94
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TARGET 87
M1899
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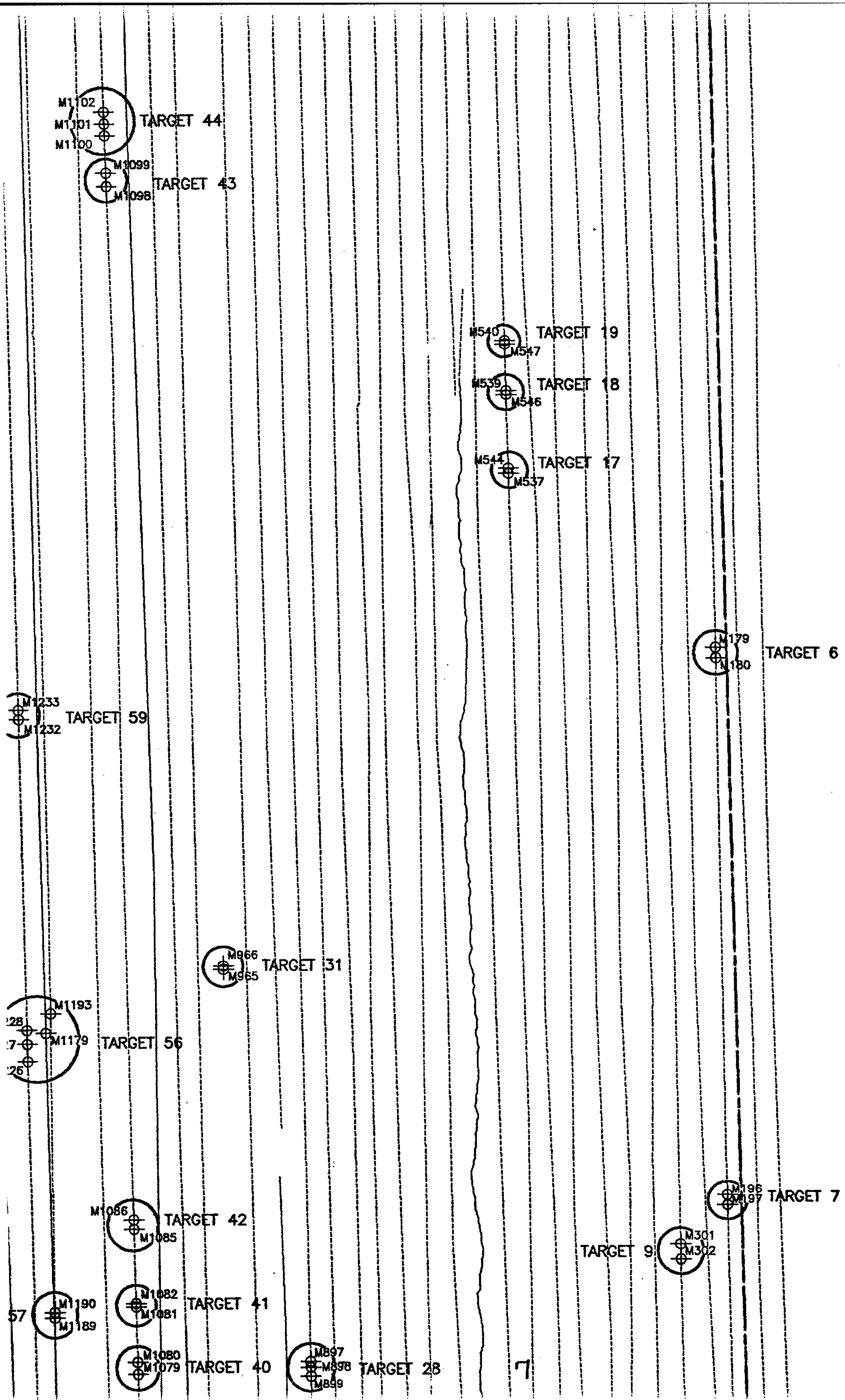
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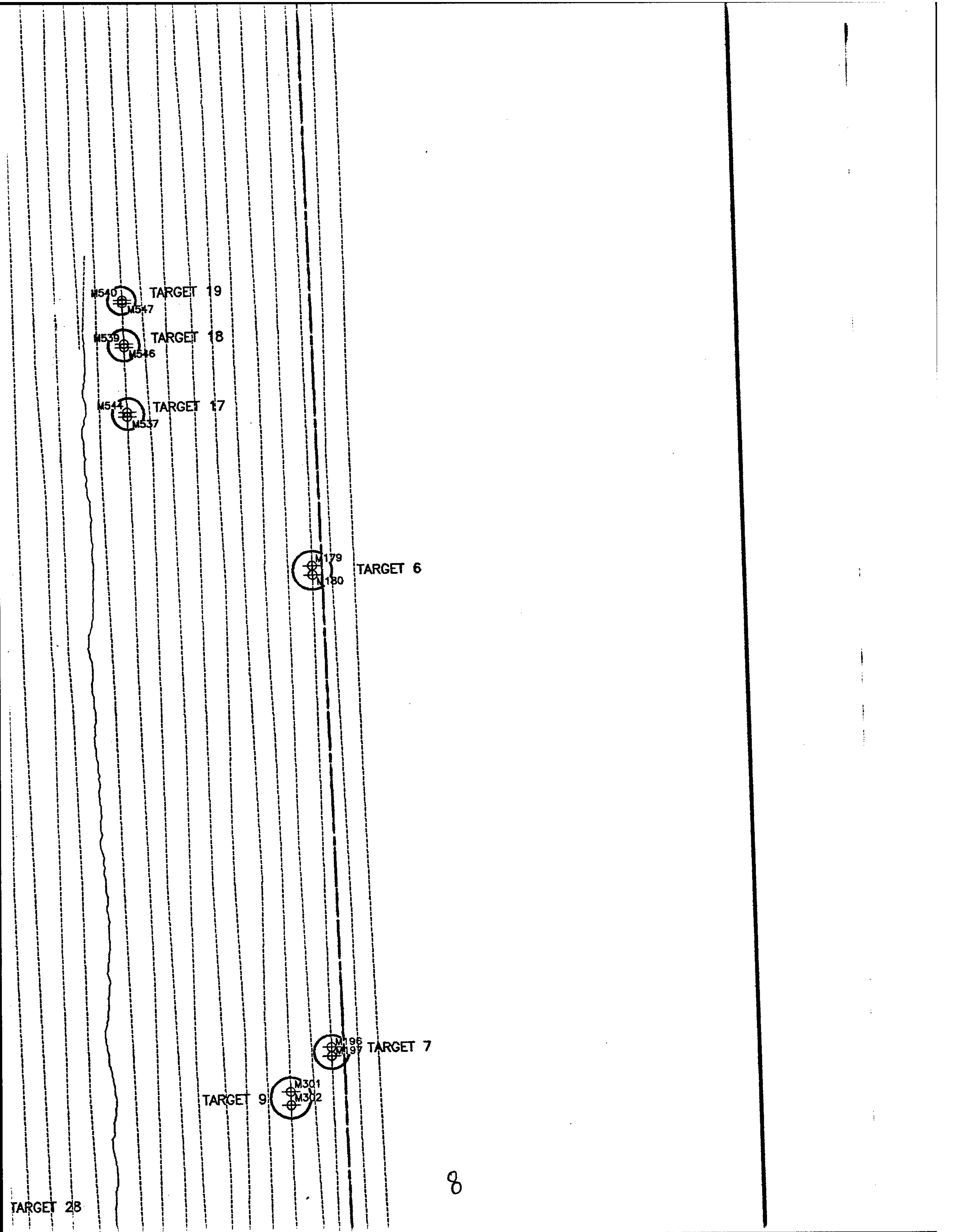
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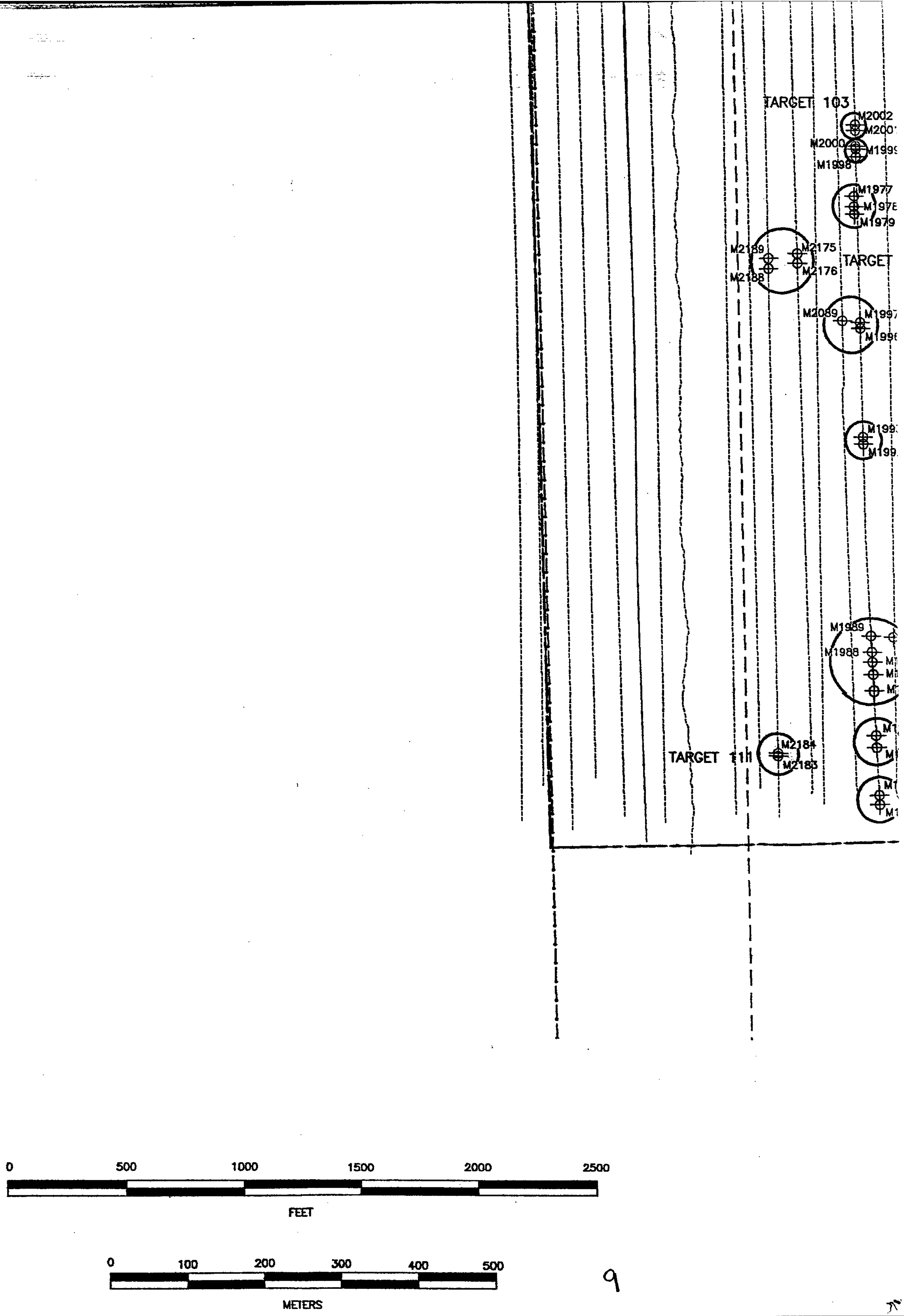
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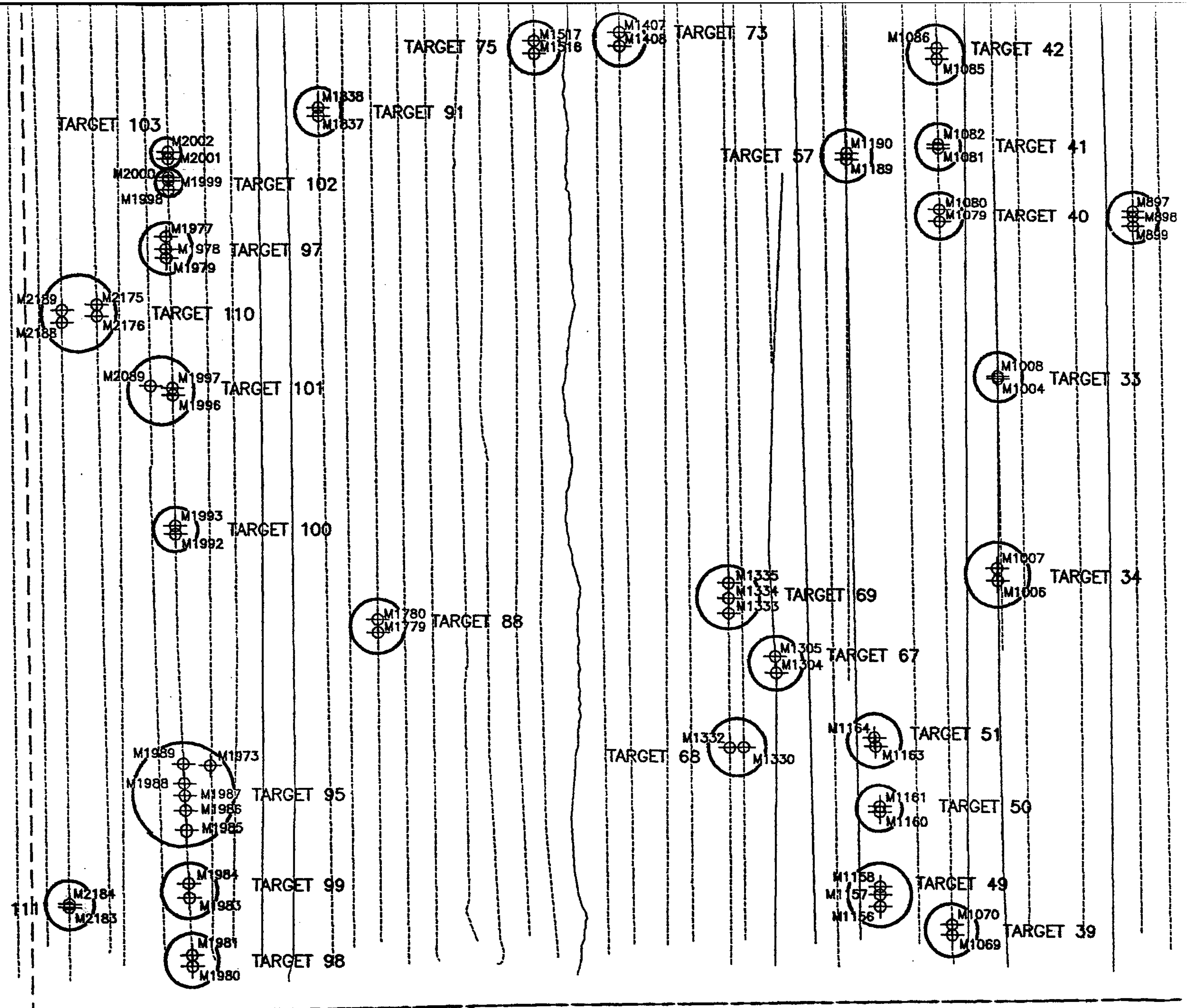
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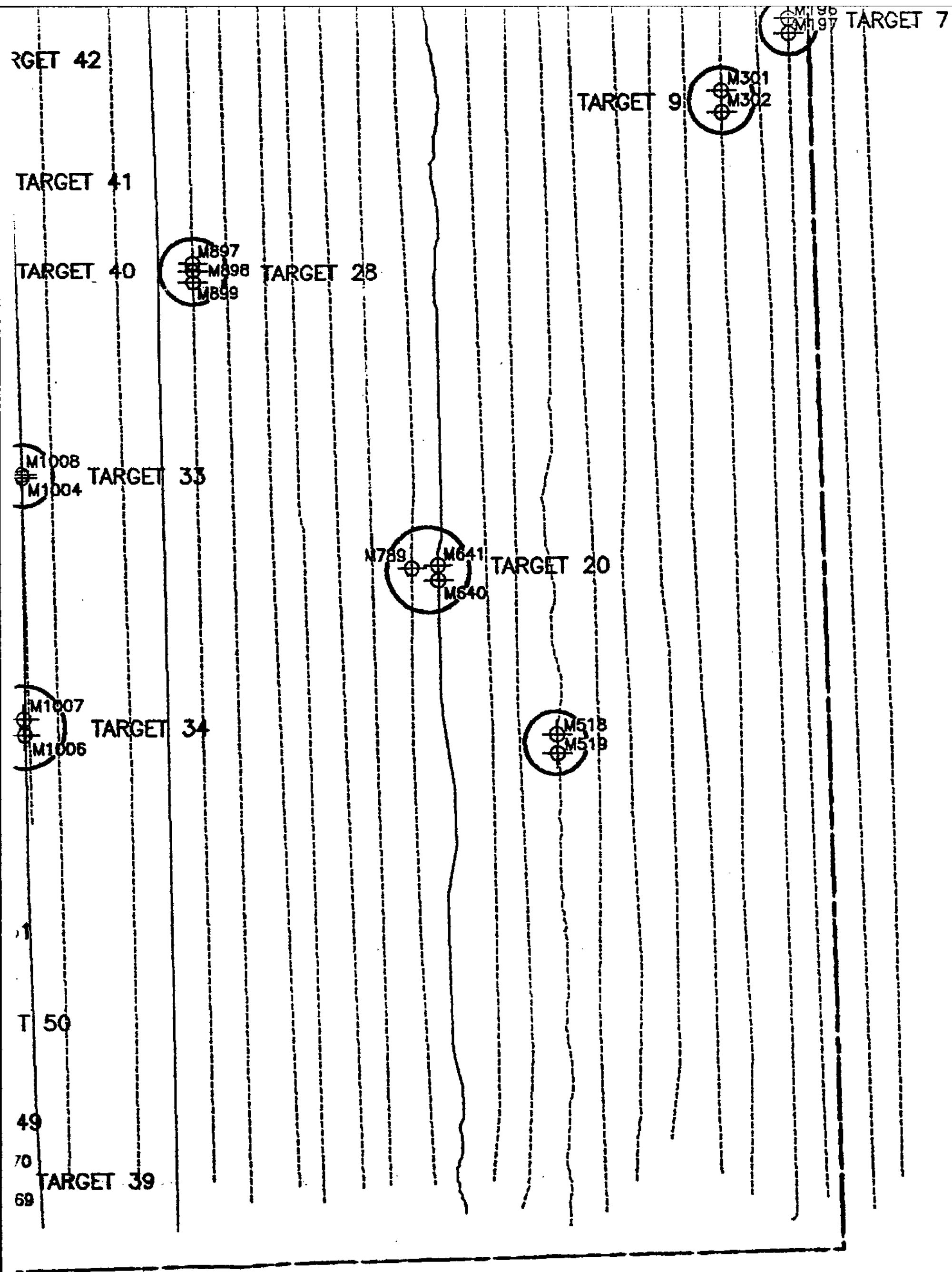
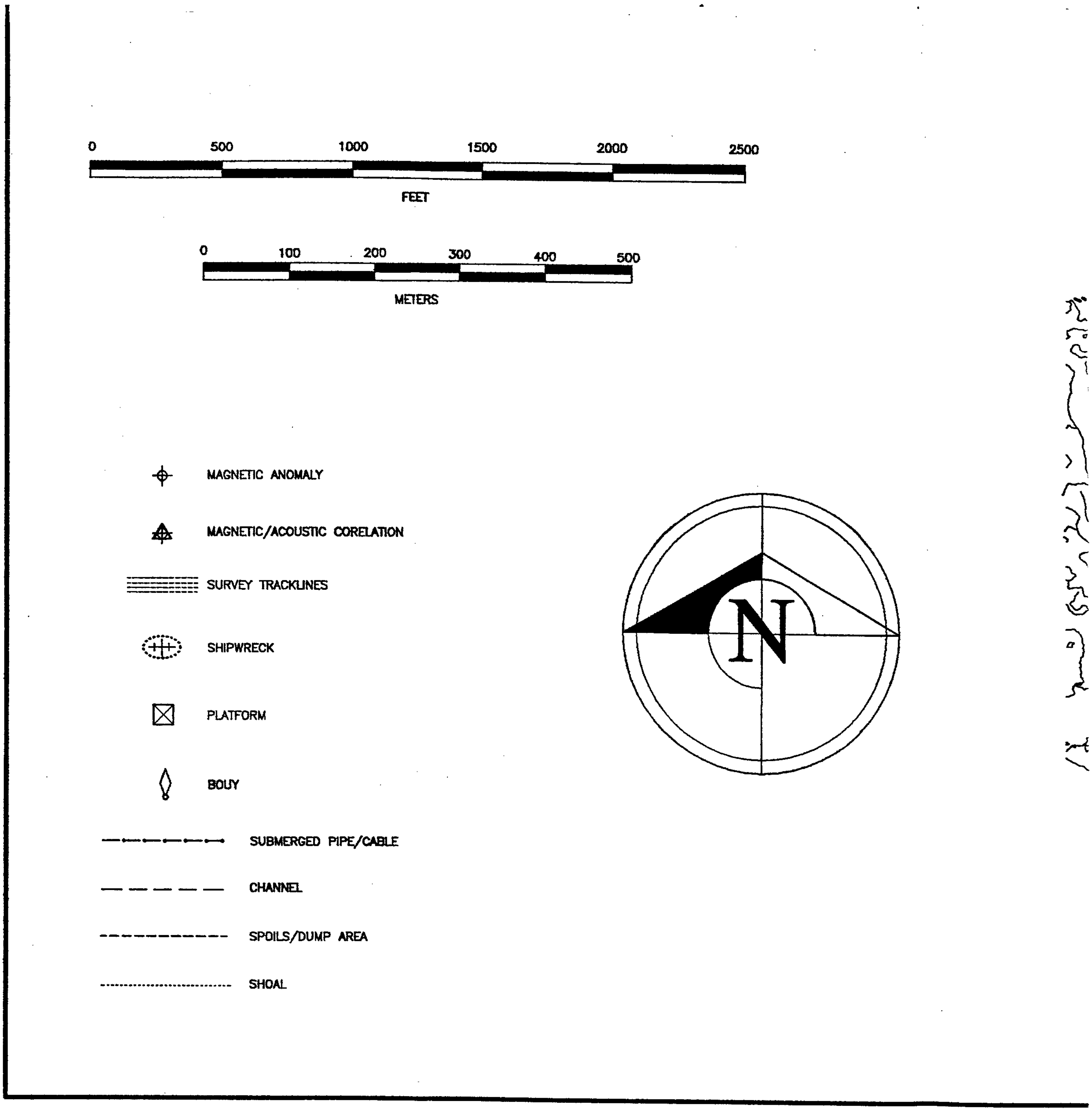


SOUTHWEST PASS



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PLATFORM
BOUY
SUBMERGED PIPE/CABLE
CHANNEL
SPOILS/DUMP AREA
SHOAL
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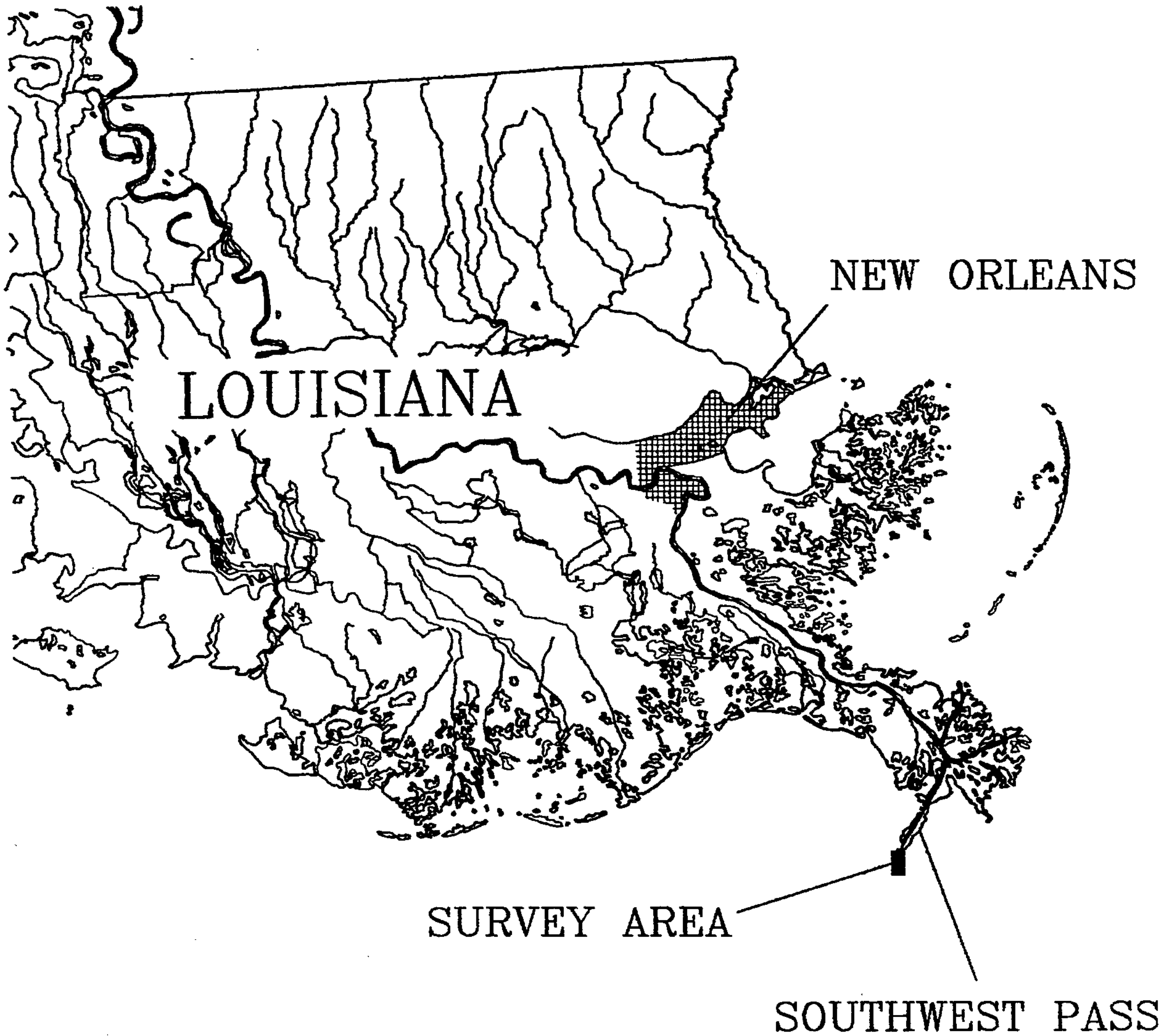
NEW ORLEANS
LOUISIANA
SURVEY AREA
SOUTHWEST PASS

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SOUTHWEST PASS ODMDS

Location of Targets Within the Survey Area

DATE: JANUARY 2000	DRAWN BY: BW
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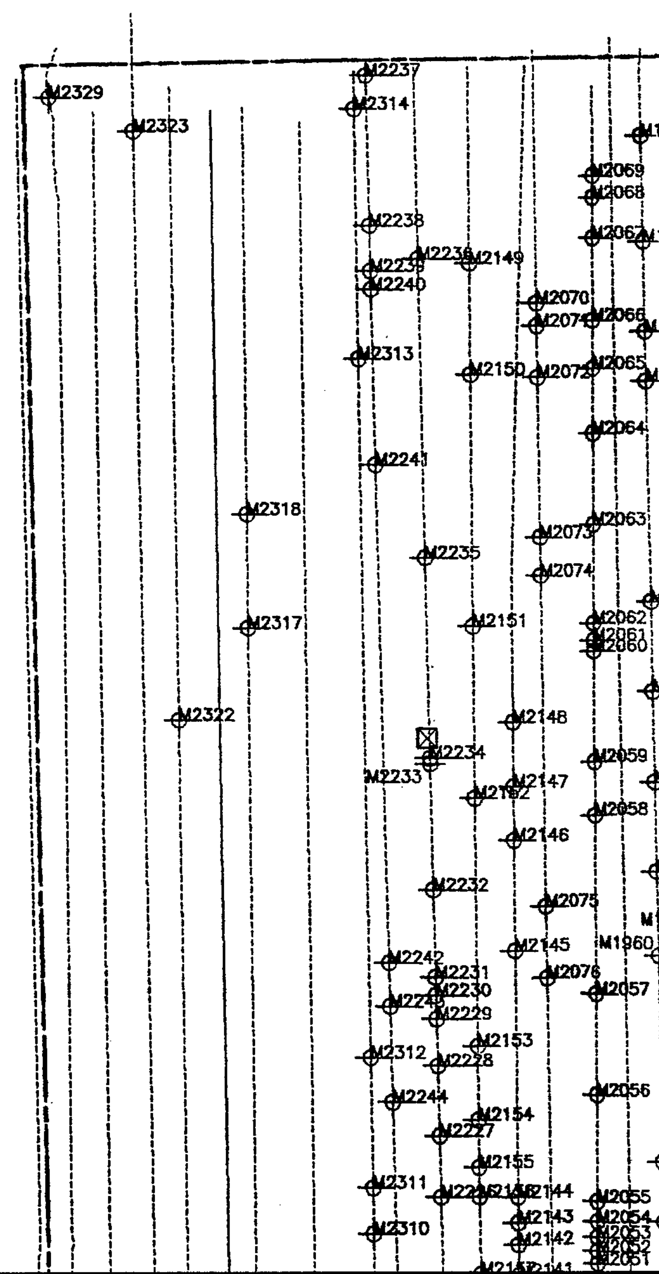
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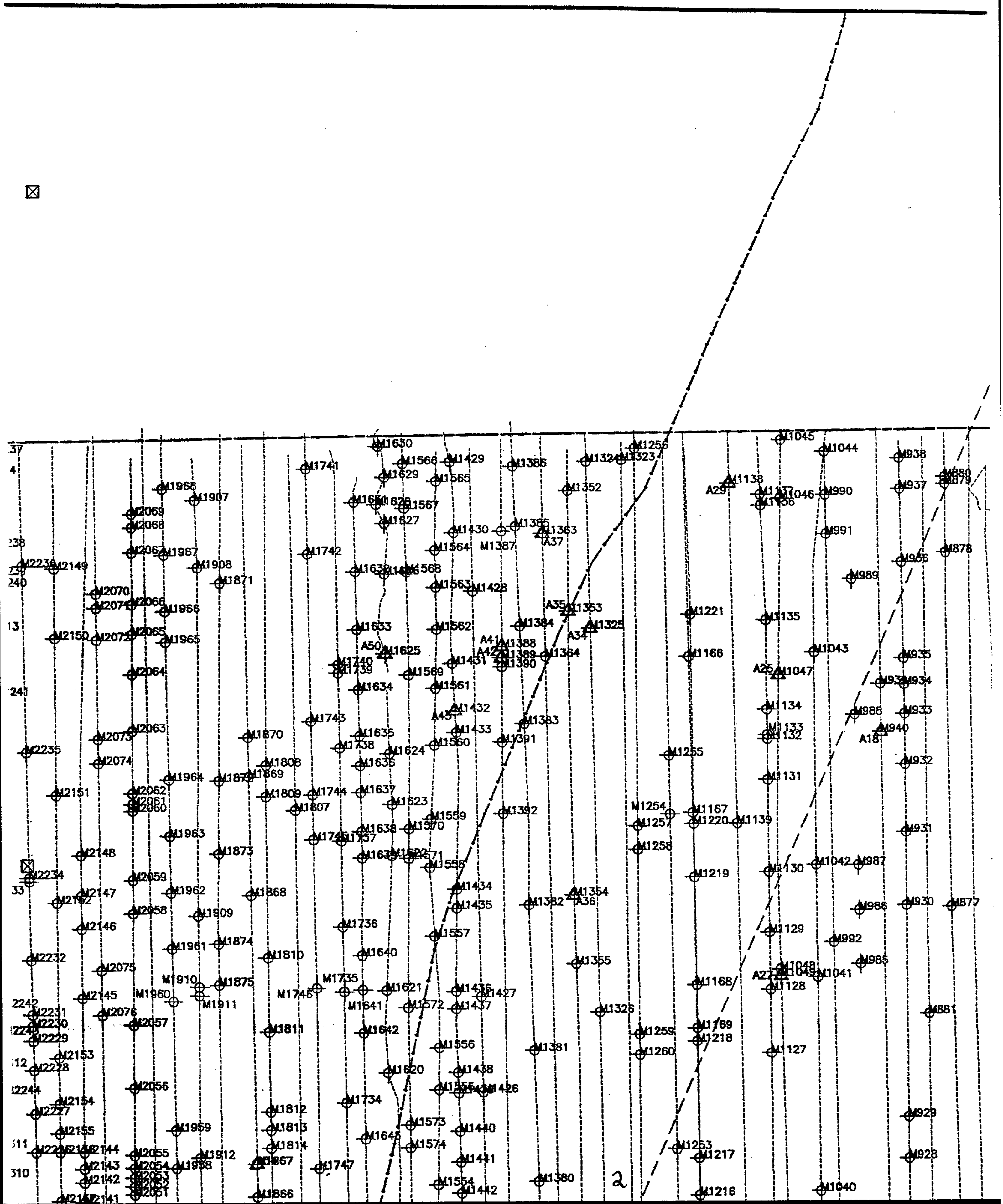

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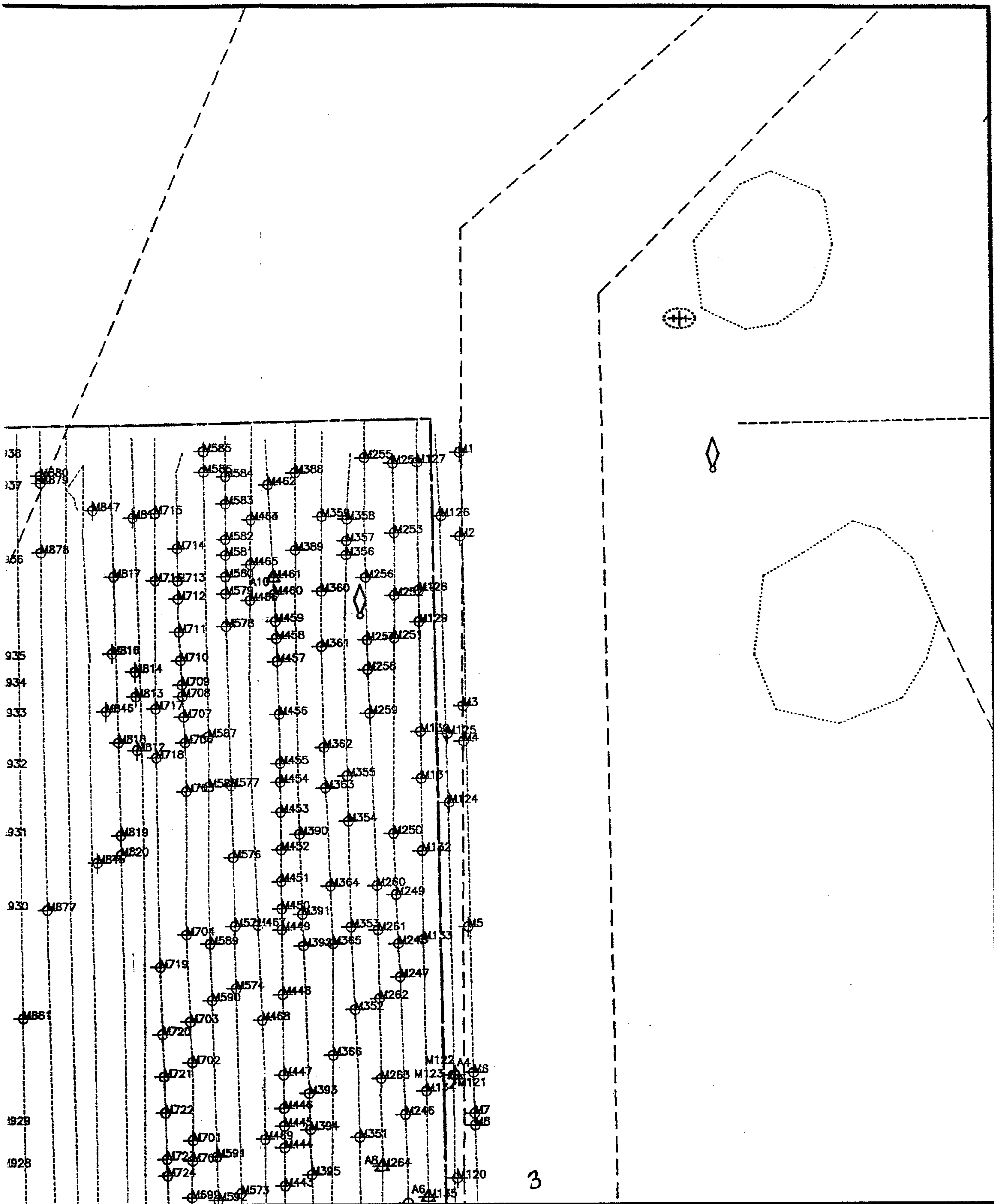
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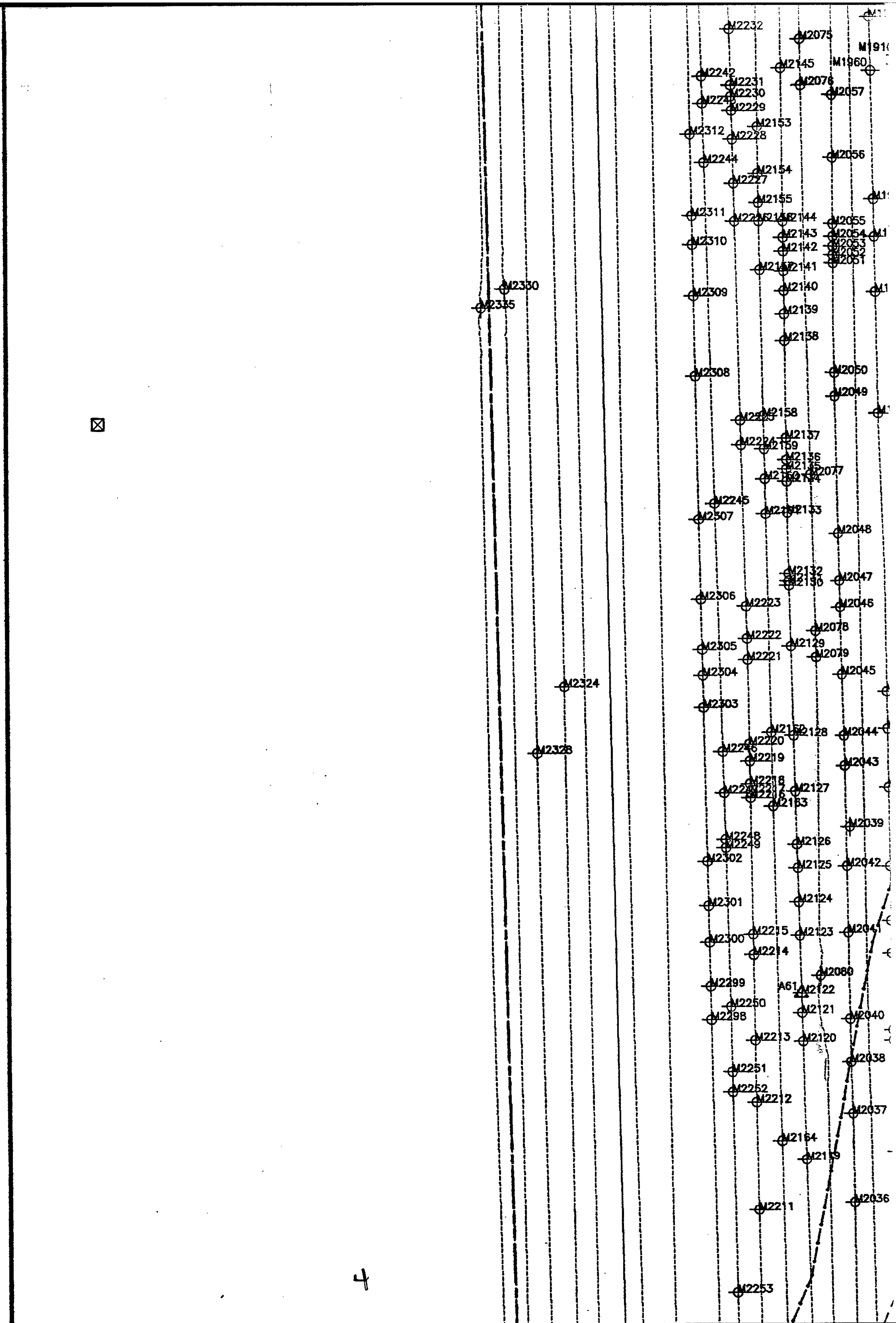
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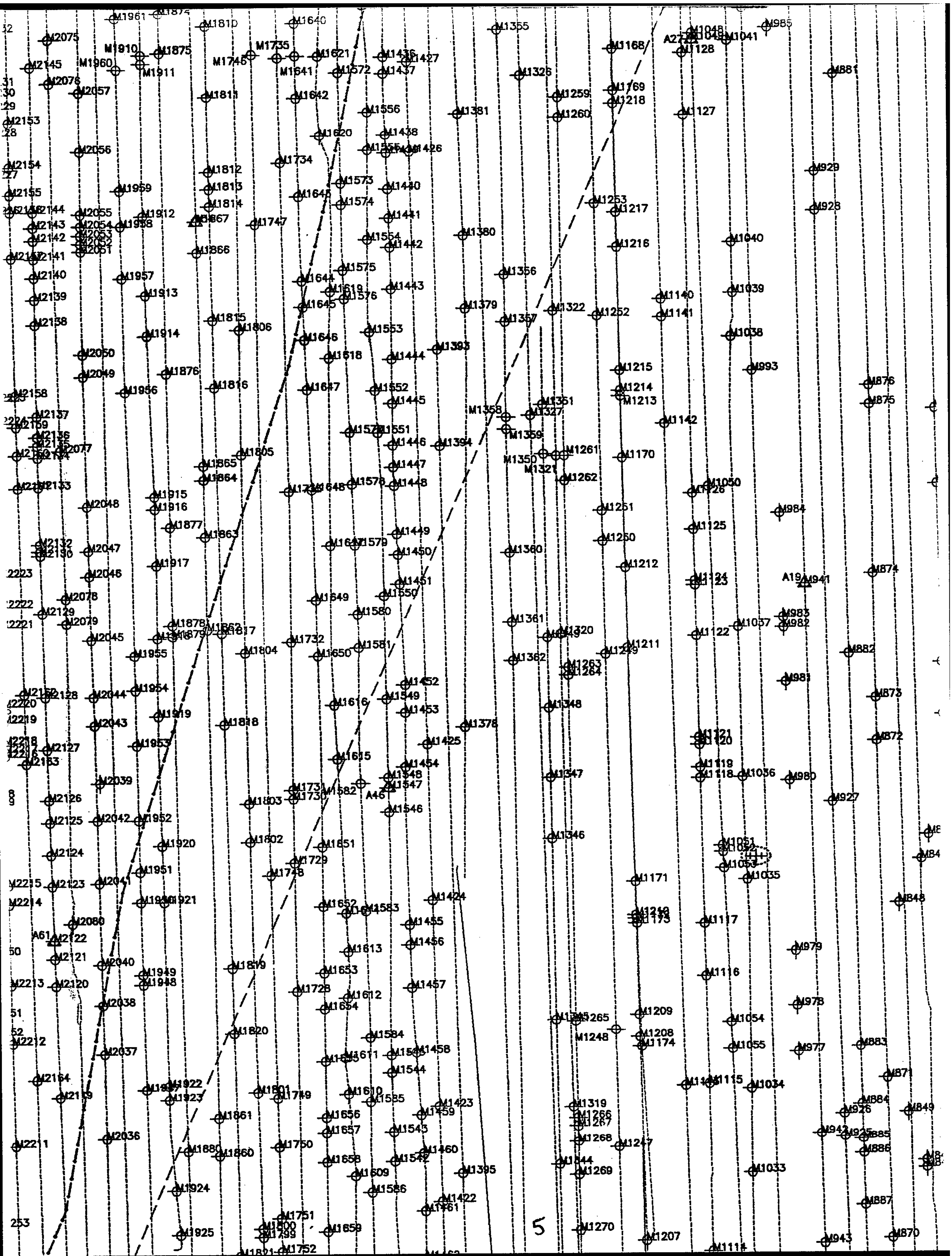

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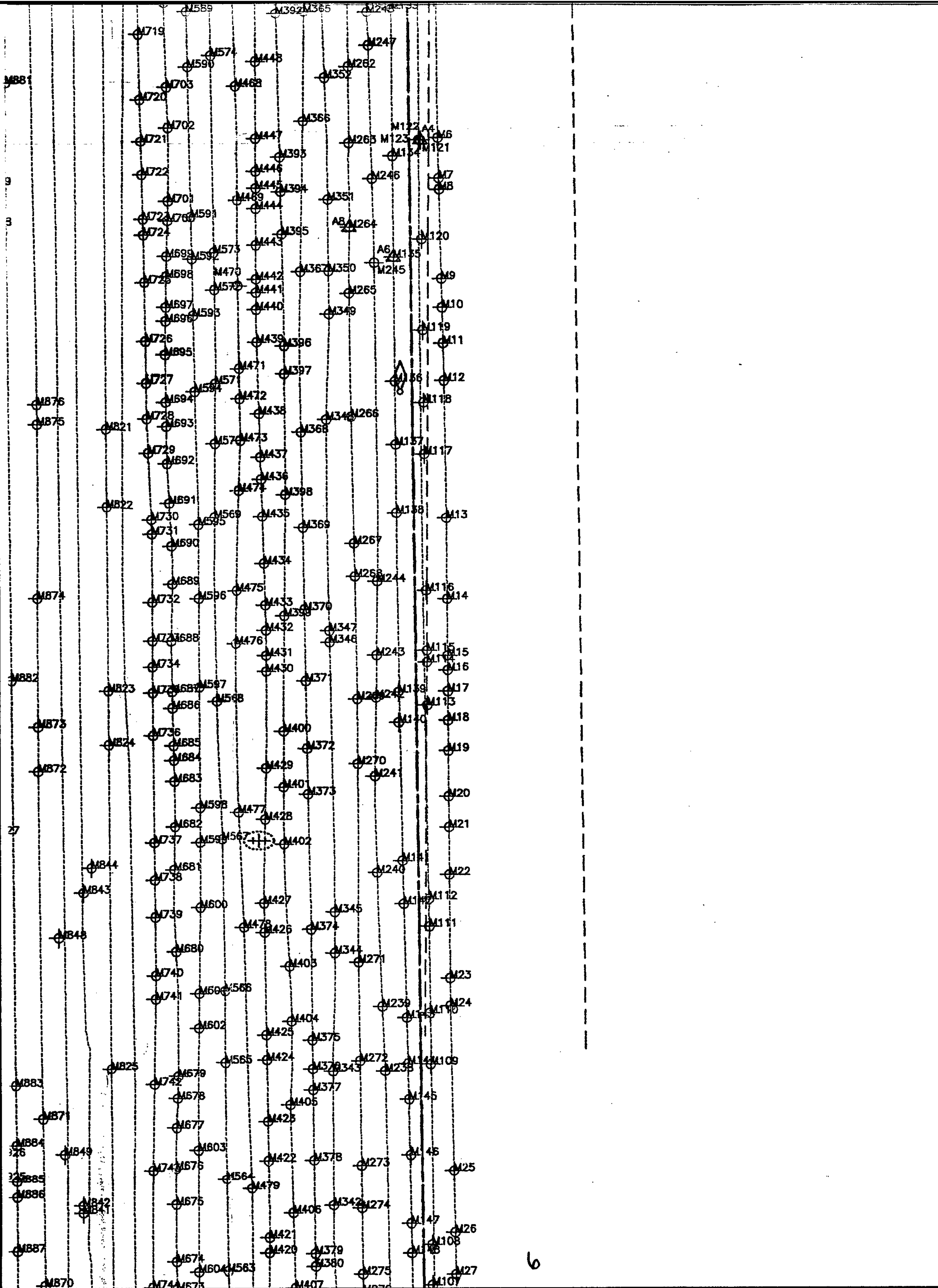

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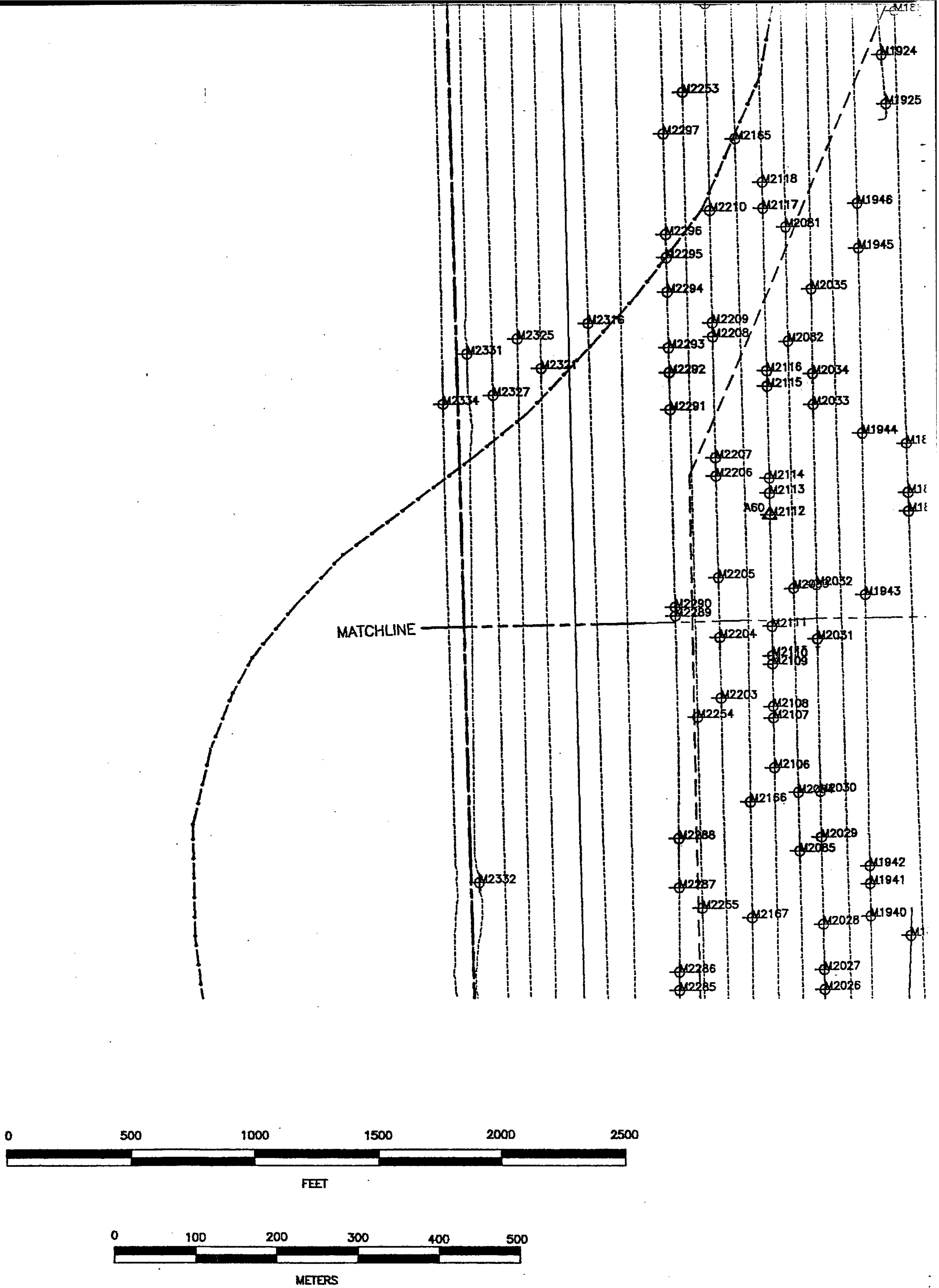
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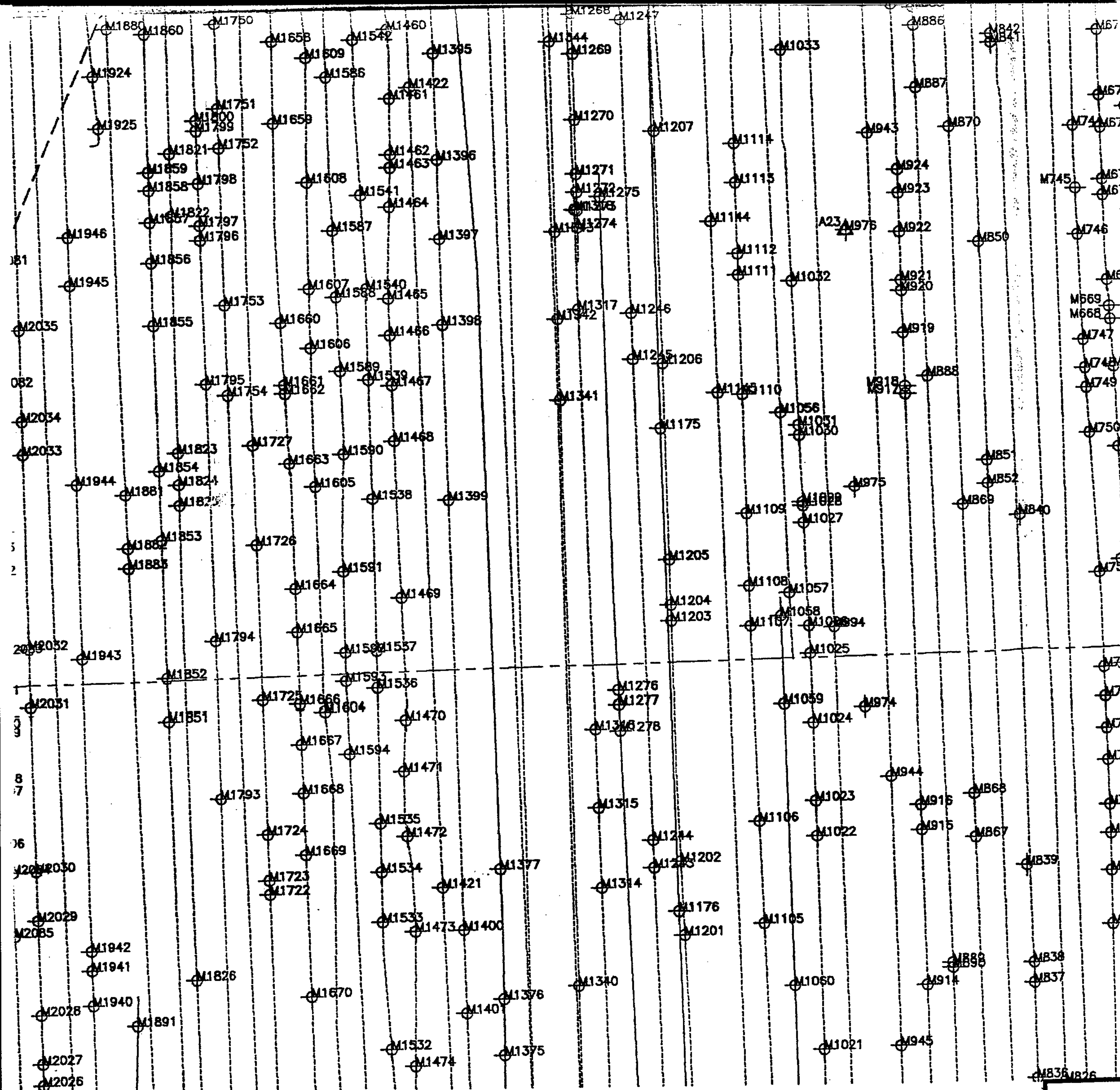
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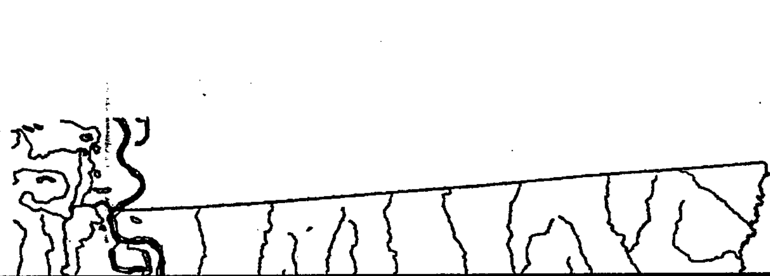

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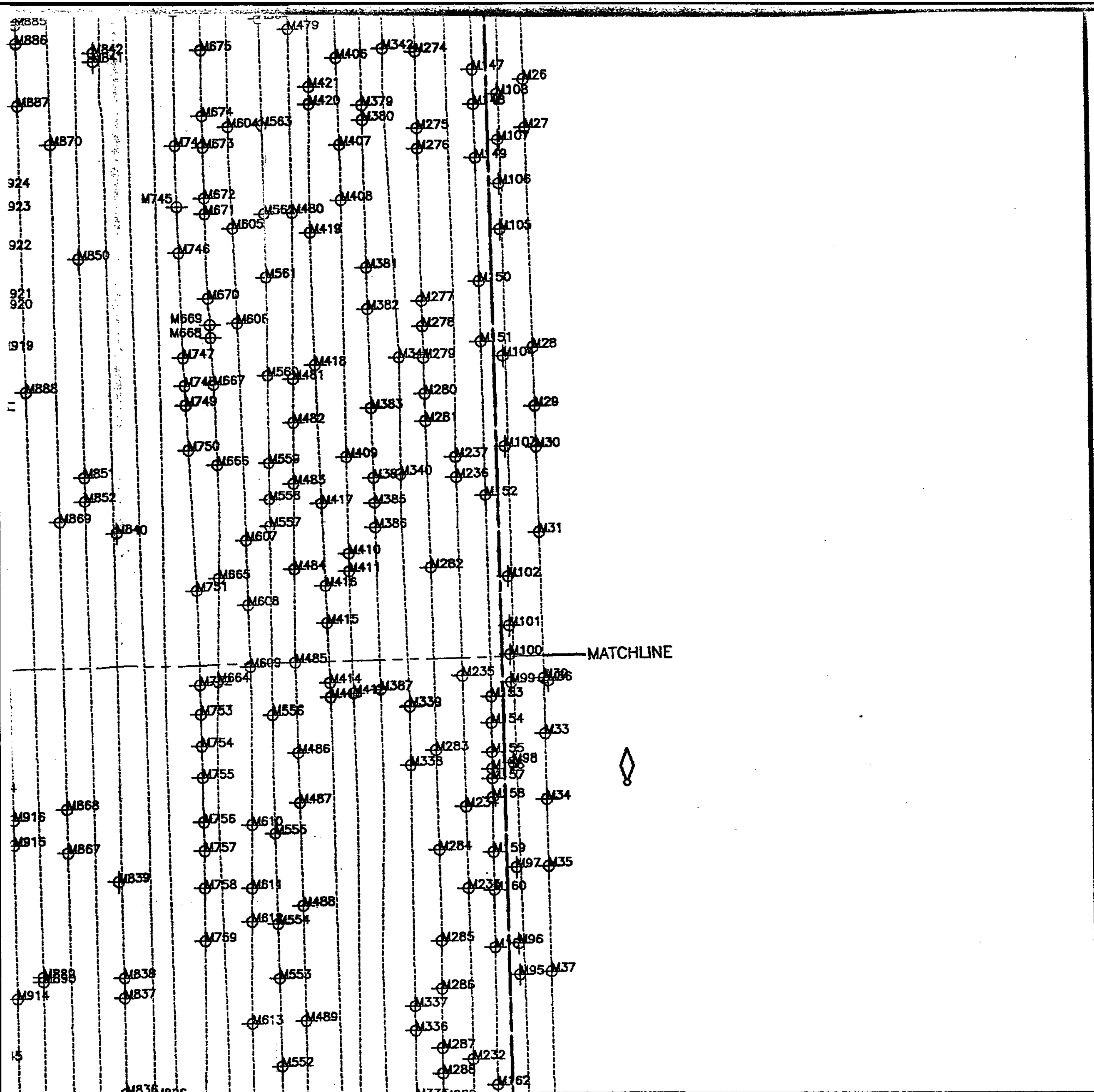

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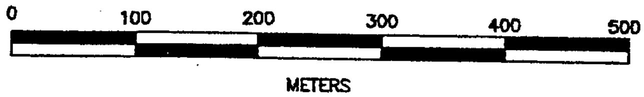
SOUTHWEST PASS

ODMDS



MAGNETIC ANOMALY

MAGNETIC/ACOUSTIC CORELATION

SURVEY TRACKLINES

SHIPWRECK

PLATFORM

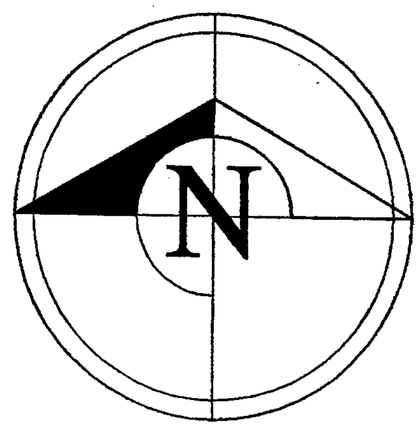
BOUY

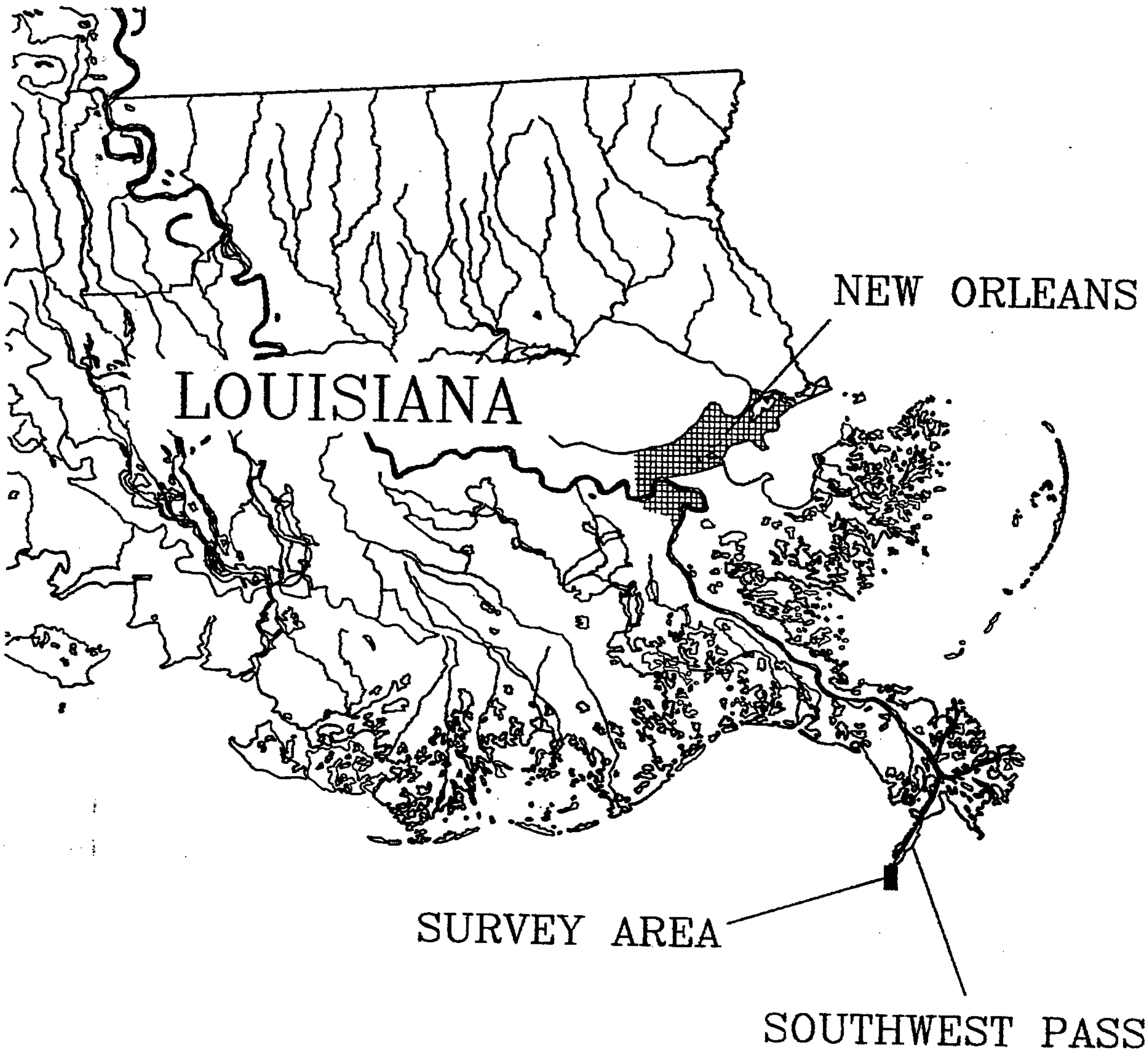
SUBMERGED PIPE/CABLE

CHANNEL

SPOILS/DUMP AREA

SHOAL




NEW ORLEANS
LOUISIANA
SURVEY AREA
SOUTHWEST PASS

SOUTHWEST PASS ODMDS

Location of Magnetic Anomalies Within the Survey Area

DATE: JANUARY 2000	DRAWN BY: BW
SHEET 1 of 2	R. CHRISTOPHER GOODWIN & ASSOCIATES, INC. 241 EAST FOURTH STREET, FREDERICK, MARYLAND 21701 1.301.694.0428

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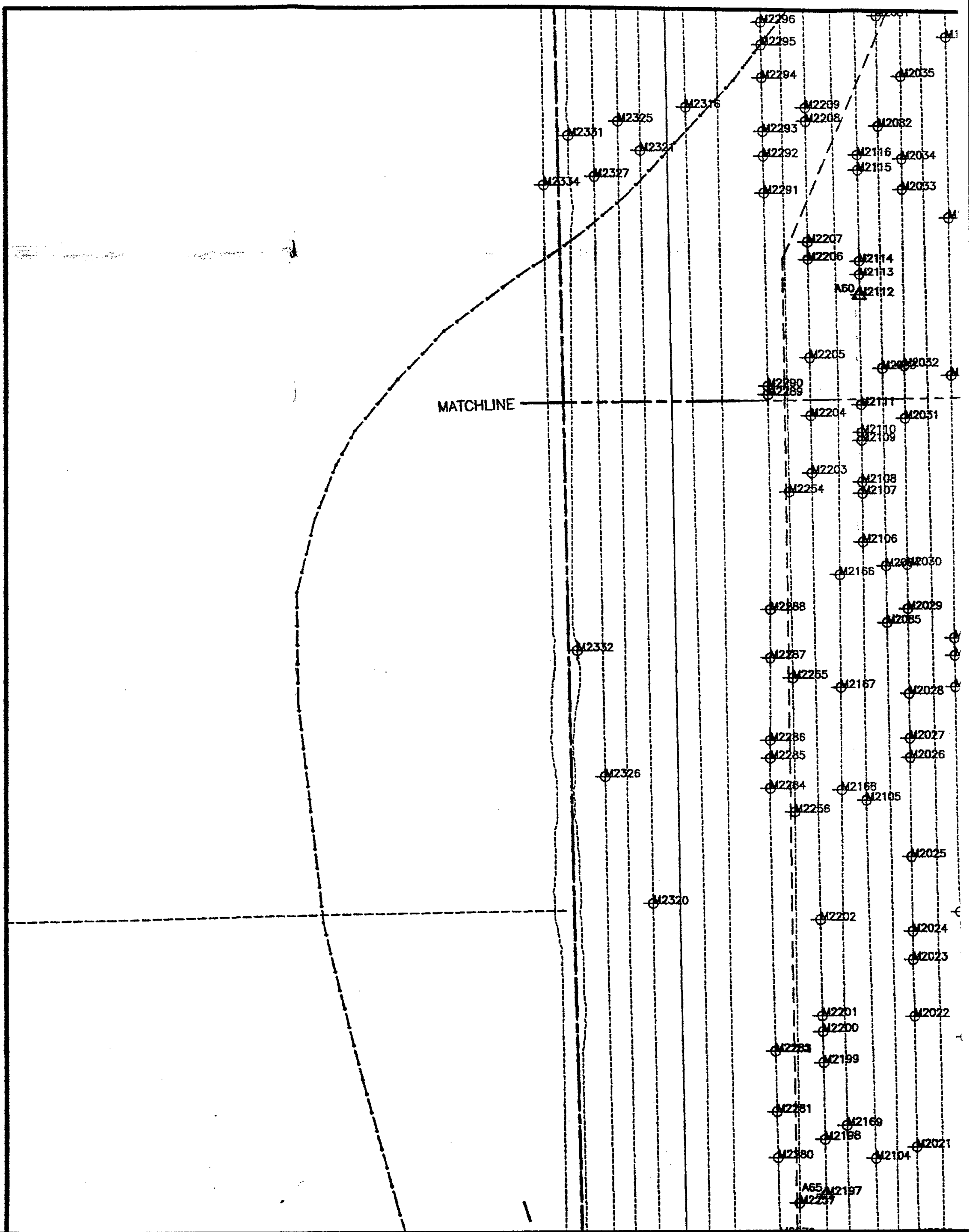
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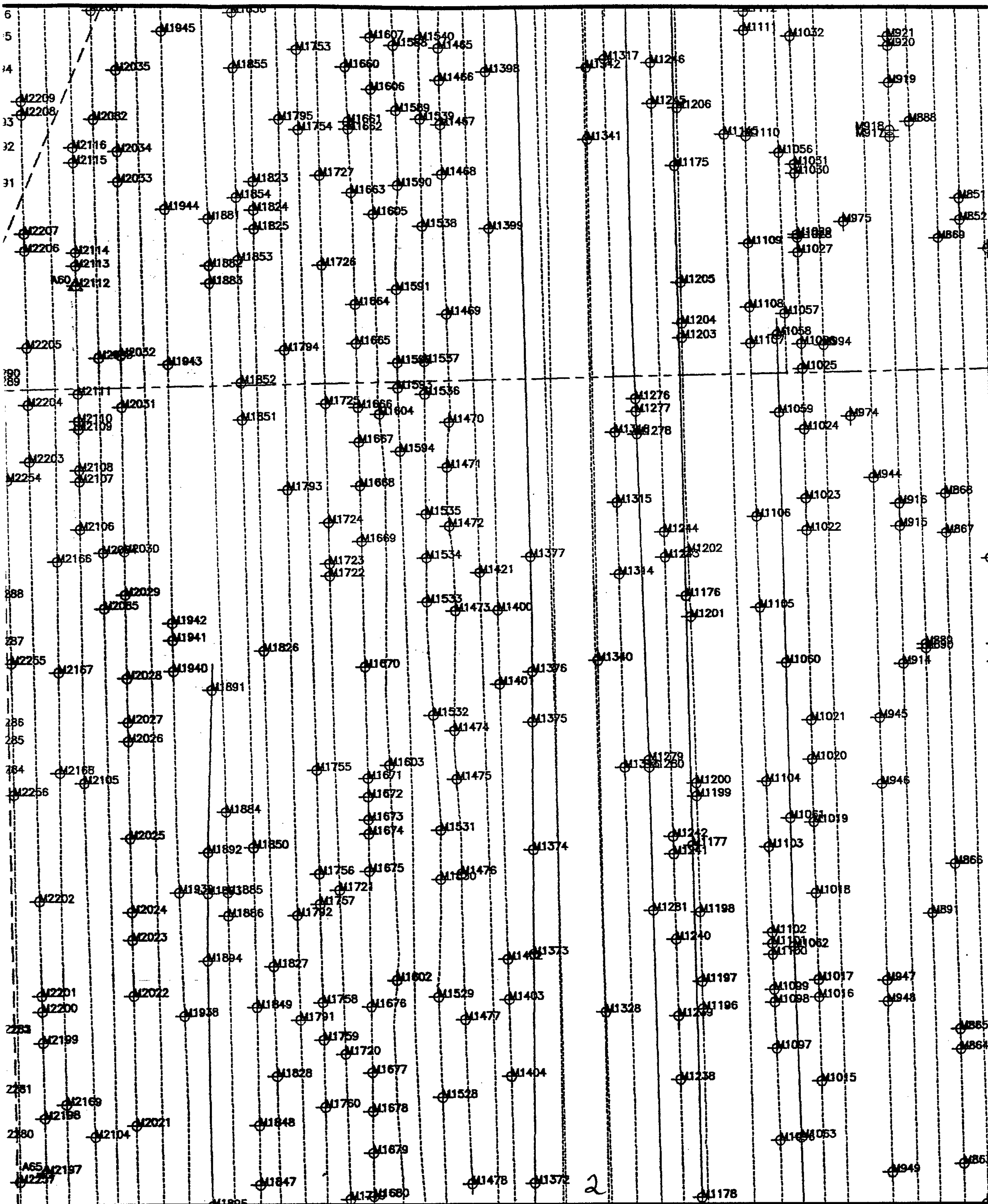

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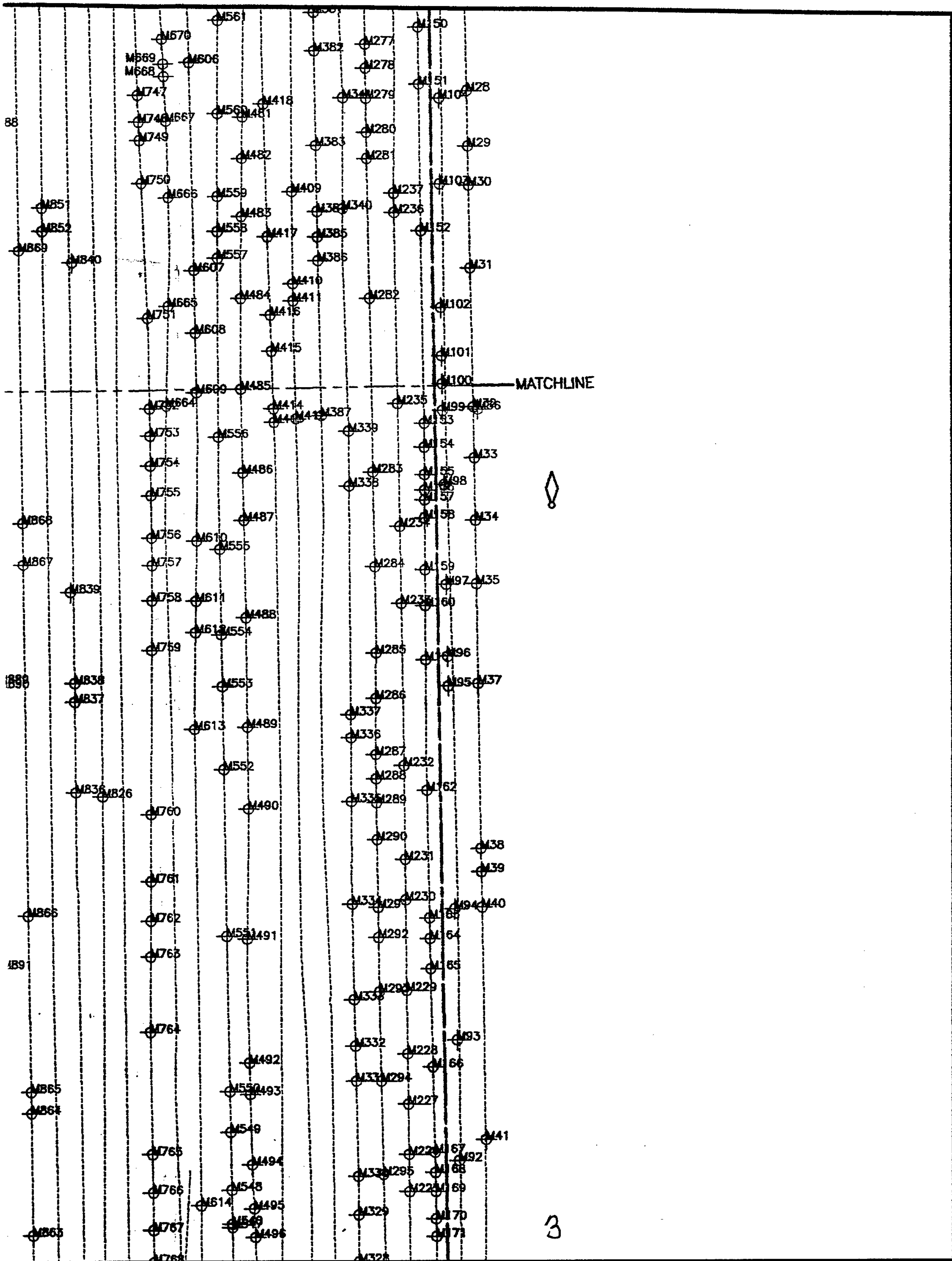
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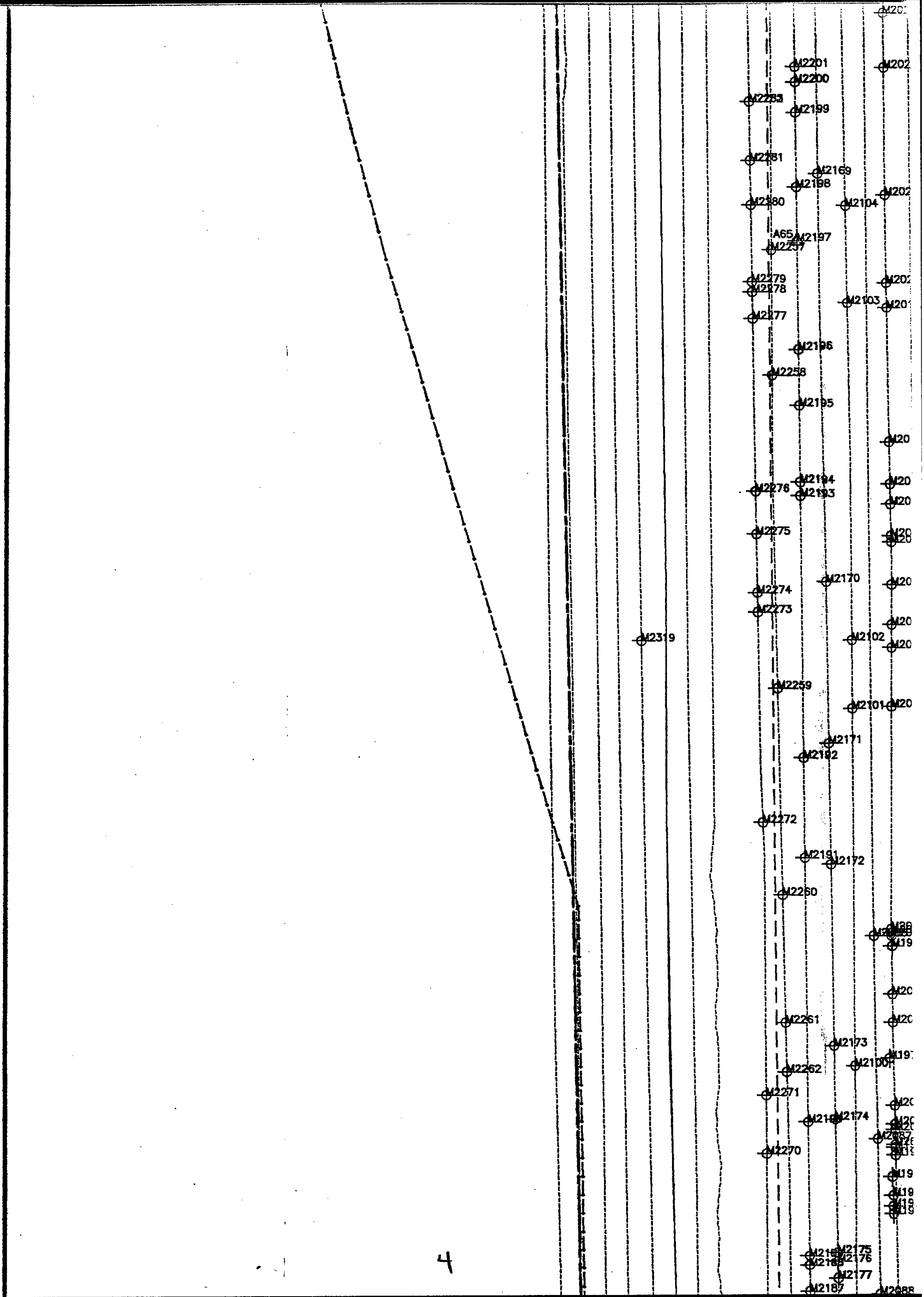
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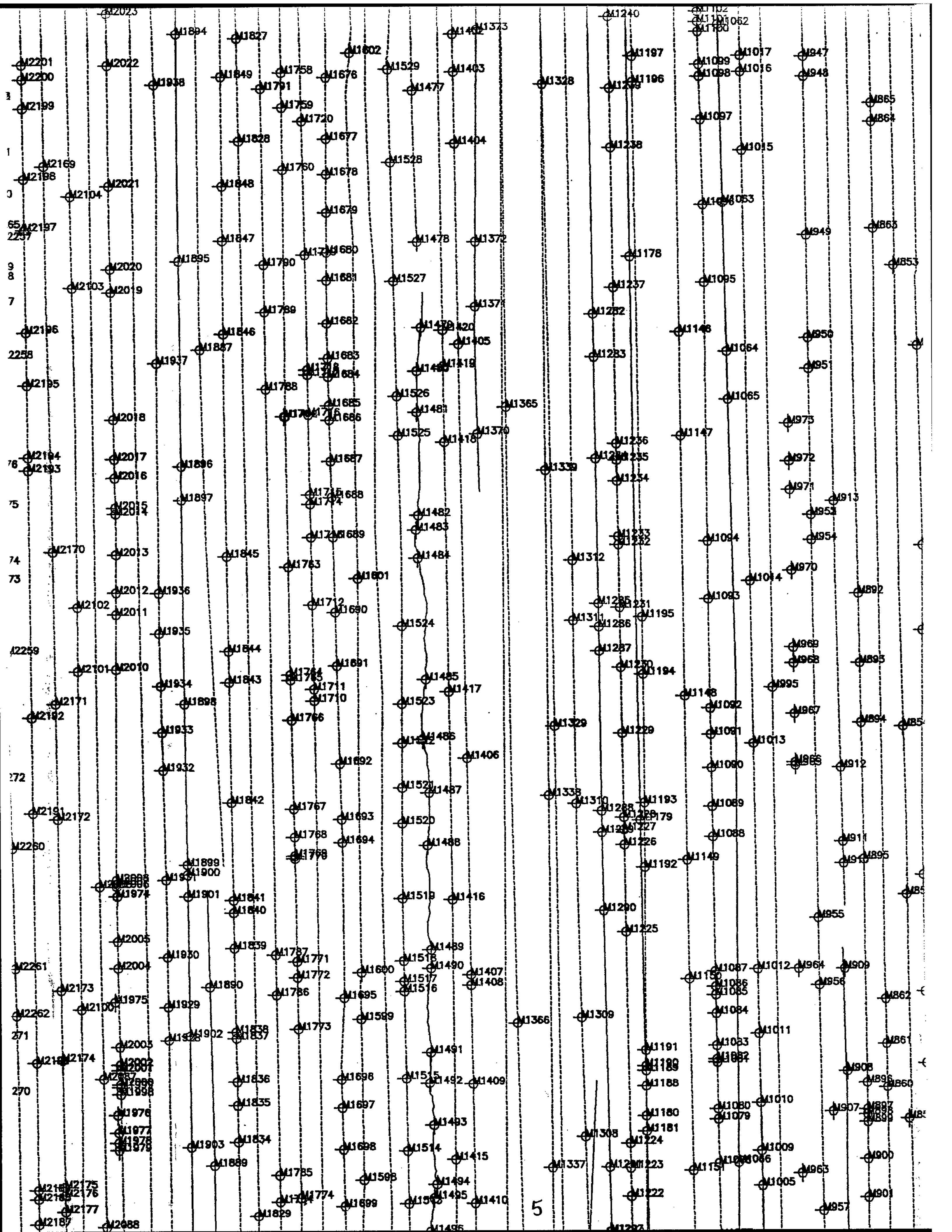

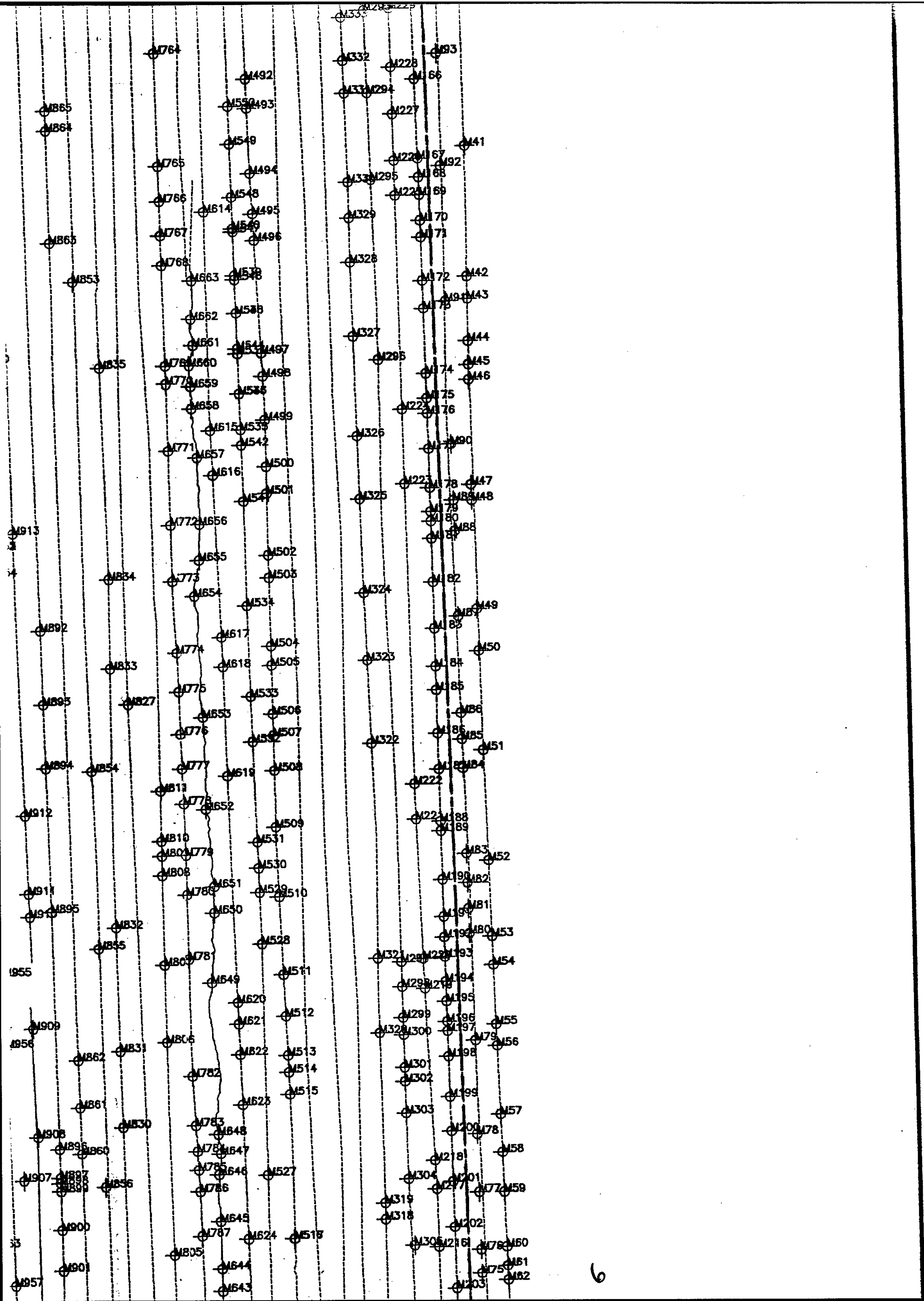
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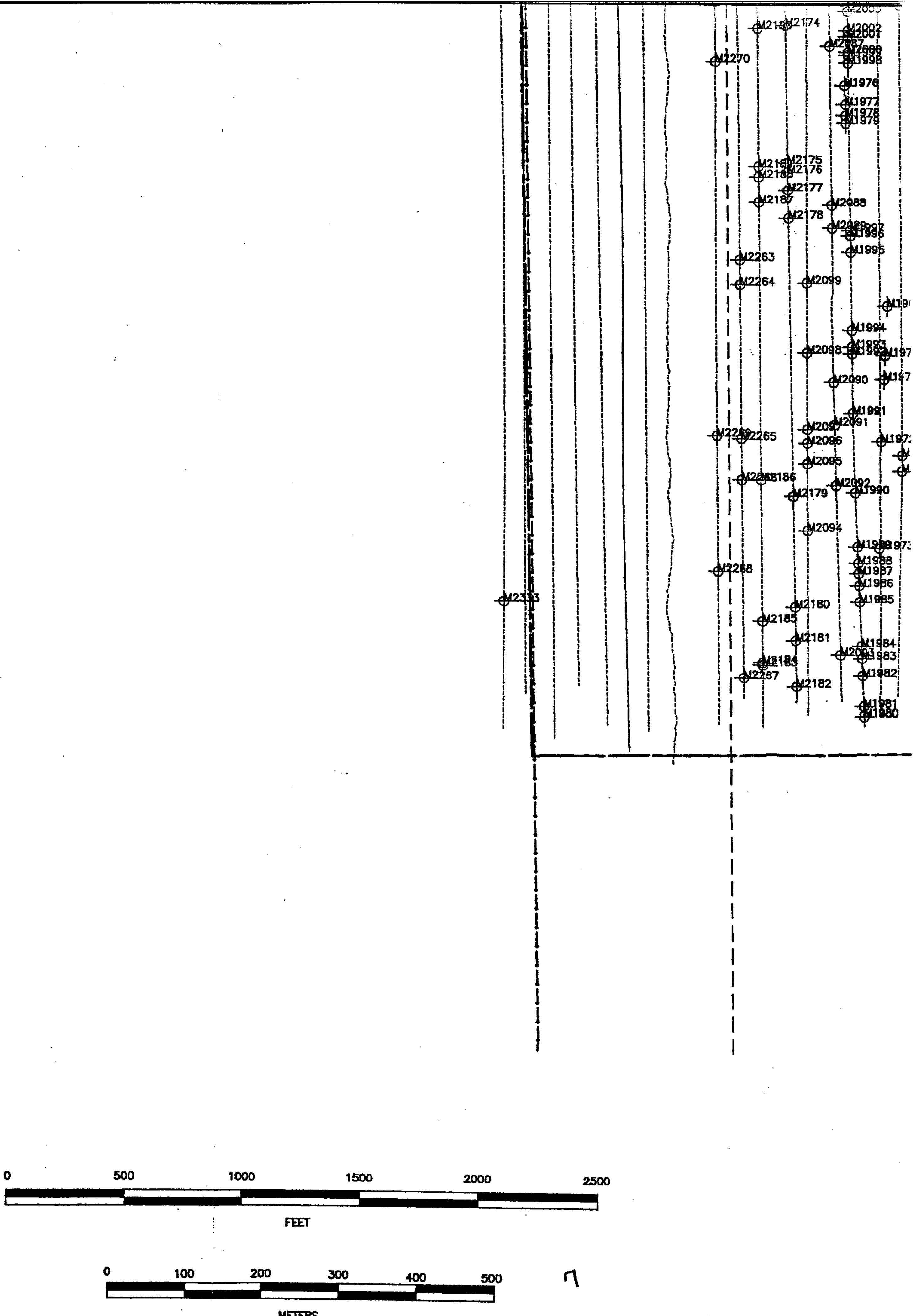
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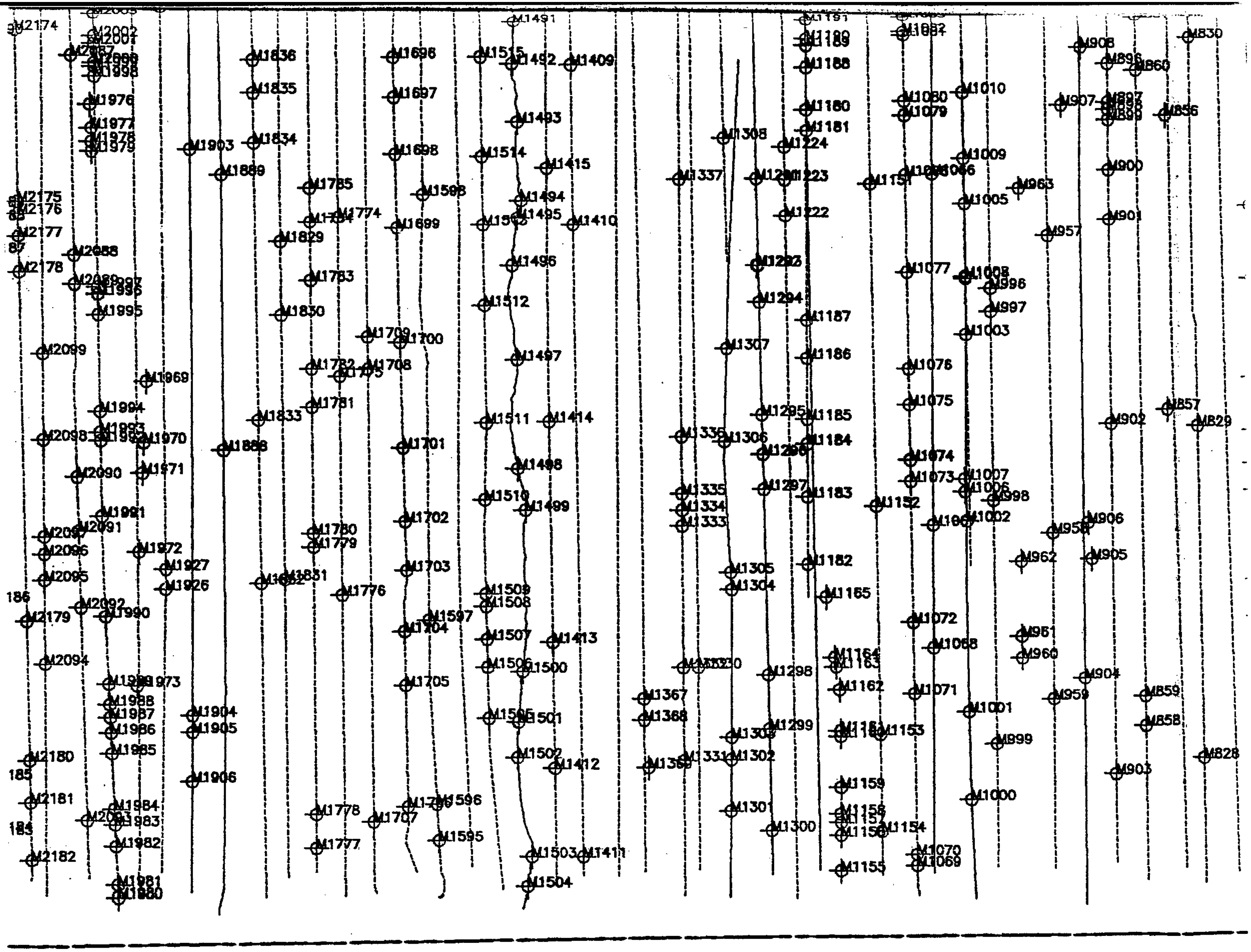
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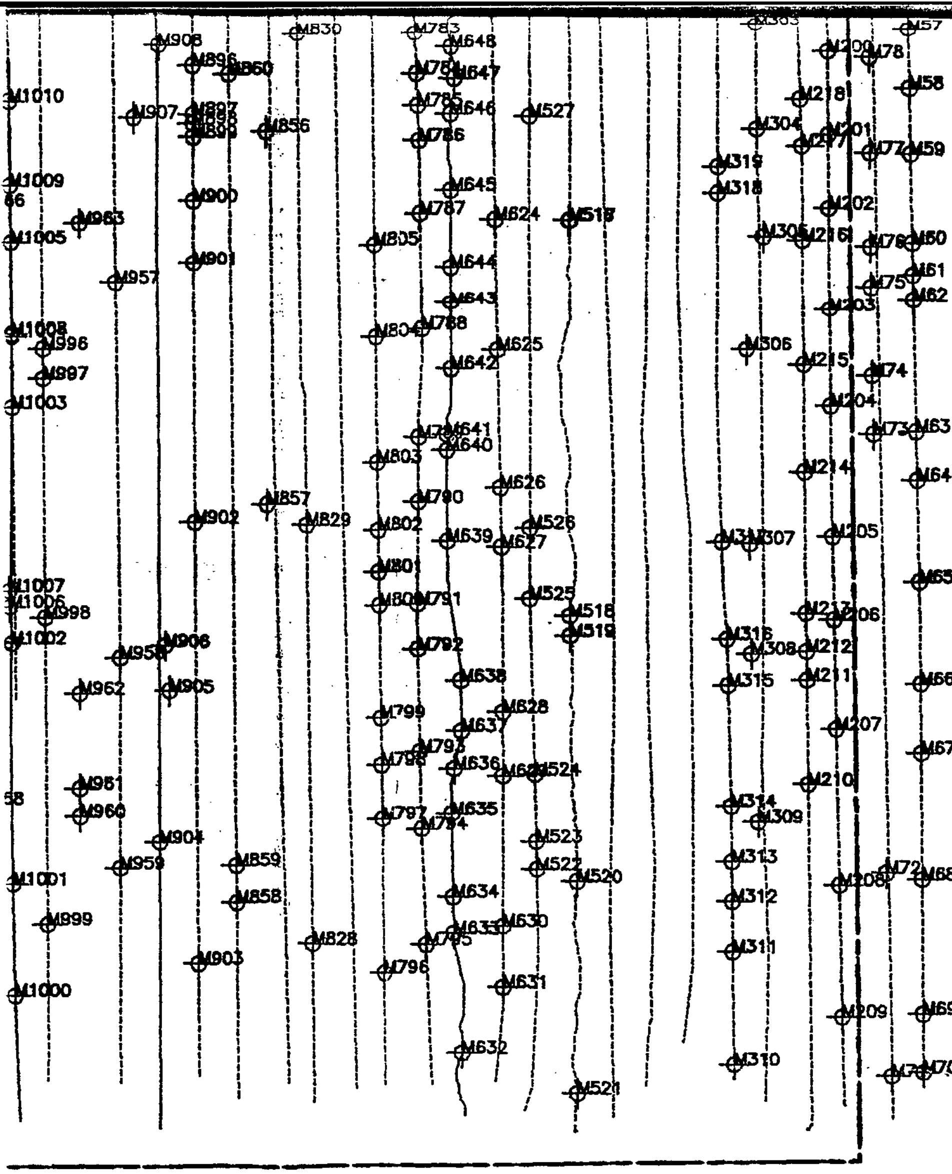

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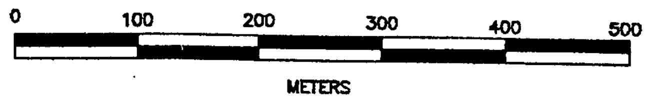
SOUTHWEST PASS



MAGNETIC ANOMALY

MAGNETIC/ACOUSTIC CORELATION

SURVEY TRACKLINES

SHIPWRECK

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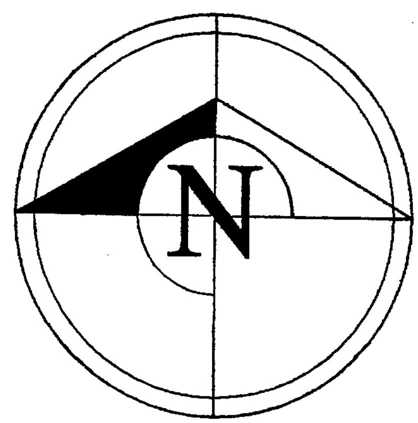
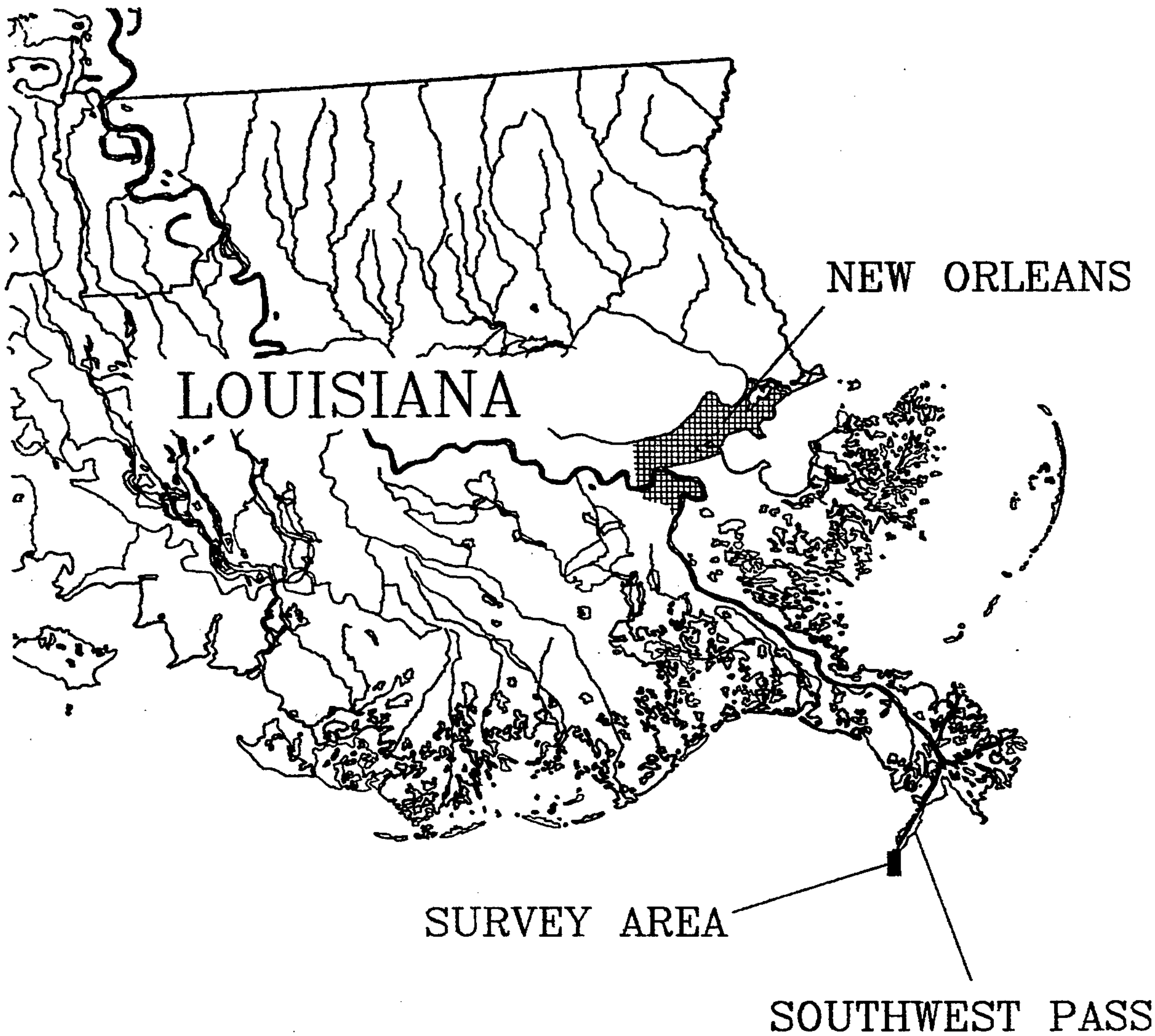
SHOAL




NEW ORLEANS
LOUISIANA
SURVEY AREA
SOUTHWEST PASS

NS

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SOUTHWEST PASS ODMDS

Location of Magnetic Anomalies Within the Survey Area

DATE: JANUARY 2000	DRAWN BY: BW
SHEET 2 of 2	R. CHRISTOPHER GOODWIN & ASSOCIATES, INC.
	241 EAST FOURTH STREET, FREDERICK, MARYLAND 21701 1.301.694.0428